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A CASE OF CHRONIC NEPHRITIS IN A COW.

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THE following case is of interest, not only on account of the infrequency of the disease in animals, but from the light which its study throws on some of the questions in renal pathology.

In January last, a cow supposed to have some form of chronic lung trouble was killed by the government inspector. I am indebted to Dr. Faville for the organs. Little was known about the history of the cow. She had coughed for several months past and was greatly emaciated. At the autopsy, considerable broncho-pneumonia was found; there was no tuberculosis, and all the other organs were healthy, except the kidneys. The kidneys were greatly enlarged, both of about the same size and general appearance, and weighed together 2945 grams. They were somewhat paler than normal. The capsule was tightly adherent, particularly in the depressions between the renculi, and could not be stripped off without tearing away small portions of the cortex. The kidney was firmer and tougher than normal. All over the surface there were minute white opaque points from 1 to 2 mm. in diameter, having much the appearance of tubercles. Some of them projected slightly above the surface. They were either sharply circumscribed or they faded gradually into the surrounding structure of the kidney. They were distributed with much regularity over the surface. On section, the small nodules were principally confined to the cortex, but in places they extended from this into the pyramids. They were oblong in shape, following the course of the tubules, and in several instances extended as

white streaks along the collecting tubules, from the cortex into the pyramids. The whole cortex between the nodules were pale, translucent and succulent; a considerable amount of fluid could be pressed from the cut surface. On squeezing the larger of the nodules, a small amount of pus-like fluid escaped, but the contents of the smaller could not be squeezed out. The ureters, bladder and vagina were perfectly healthy. The bladder contracted and empty.

Small flat pieces of the cortex were at once placed in a relatively large amount of Flemming's solution. Other pieces were hardened in alcohol and Müller's fluid. Cover-slip preparations made from the contents of the larger nodules showed numerous pus cells and considerable numbers of short oval bacilli. Fresh frozen sections showed a slight fatty degeneration of the tubules near the foci. There were numerous pus cells in the foci and in the adjacent tubules. In the centre of each there was sometimes a granular mass composed of broken-down pus cells and epithelium. In the tissue around the foci there was some increase in the connective tissue, with round-cell infiltration between the tubules. No alterations could be made out in the glomeruli.

Of the hardened tissues, those from the Flemming's solution gave the best results. It might be well here to say a word about the value of Flemming's solution as an agent for hardening kidney. There is no hardening agent which combines so many advantages as this. Its greatest value is in preserving the nuclear figure, so that we can tell where cell proliferation is taking place, but its instantaneous fixing properties render it hardly less valuable. The albumen is at once coagulated, and no better preparations for the study of the albuminous exudation around the glomeruli can be obtained, either by boiling the tissue or hardening in absolute alcohol. The cells are perfectly preserved, and the cloudy swelling and fatty degeneration is as clear as on fresh sections. The finer changes in the cells are not so evident, when the tissues are taken 24 hours or longer after death, but in autopsies made a few hours after death I have obtained almost as perfect results as in tissues from the perfectly fresh animal. Sections not more than 1 mm. in thickness should be placed in a comparatively large amount of the fluid. They remain in the fluid 24—48 hours, are then washed out in water 24 hours, and placed in alcohol. They may be embedded in paraffin or celloidin. The only disadvantage to be found in its use is the alteration of the red corpuscles. These are sometimes perfectly preserved, but

oftener changed into a homogeneous mass in which the individual corpuscles cannot be recognized. The sections which come from the outside, where the hardening fluid has more thoroughly acted, are always better than those deeper down.

The sections made by the tissues hardened in Flemming's solution were stained in safranin and in Weigert's hæmatoxylin. With a low power the foci appear as a mass of brightly stained nuclei. On closer examination, the cells in the centre are different from those in the periphery. In the central cells the nuclei stain very intensely, they are irregular in form, being sometimes crooked, elongated, or of a horseshoe shape. We can be sure that they are the polynuclear leucocytes. From this central mass, made up exclusively of leucocytes, they extend towards the periphery of the nodule, gradually becoming less numerous. Among the leucocytes, cells with a round nucleus which fills entirely or almost entirely the body of the cell, begin to appear, and finally nothing but these cells are seen. The nucleus does not stain as brightly as that of the polynuclear leucocytes. The relations of these two sorts of cells to the tissues are different. The round cells are exclusively found in the intertubular tissues, the leucocytes in this tissue and in the tubules.

The epithelium shows various alterations. In the centres of some of the largest nodules the epithelium has entirely disappeared, the tubules can only be recognised by the round masses of closely packed leucocytes. In some the leucocytes are also involved in the necrosis, and the centre is composed of a granular mass filled with brightly staining fragments of nuclear detritus. Just outside of the centre and in some cases in the centre of the nodules various forms of epithelial degeneration can be made out. Some fat granules are found, but fatty degeneration plays but a small part in the process. In the most advanced degeneration the epithelium in the dilated tubules is represented by a thin line of granular protoplasm along the membrana propria, and the leucocytes come directly against this. In some places the epithelium is entirely broken up, and fragments of tissue which may be taken for this are seen among the leucocytes. Where the degeneration is less intense, large vesicles form within the cells, the swollen cells filling the tubule. These vesicles are perfectly clear and contain no protoplasm. The nuclei are either absent, or at the base of the enlarged cells a more or less shrivelled nucleus, with a small amount of protoplasm around it, can be made out. Some of the tubules contain

coagulated albumen, others are filled with finely granular or homogeneous material in which are embedded nuclei and fragments of epithelial cells and a few leucocytes. Some of the epithelial cells are greatly swollen, the nucleus either does not stain or has fragmented, and the swollen cell is filled with larger and smaller masses of perfectly homogeneous hyaline substance which stains a faint brownish colour with the osmic acid. The mass within the tubules is of the same character as the material in the cells, and is forming from the fusing together of the hyaline masses in the degenerated cells. Sometimes it is composed of the small round masses similar to those in the cells and which have not yet fused together.

The tissue between the tubules is wider and filled with great numbers of leucocytes. These are seen in every stage of passage from the intertubular tissue into the tubules. Generally they seem to pass between the epithelial cells, in other cases the entire line of epithelium is elevated, pushed into the tubule by the crowding leucocytes. Often leucocytes are seen in the epithelial cells. There is considerable fibrin between the tubules, and small amounts of it are occasionally found within the tubules. Here and there through the kidney, collecting tubules with no change in their epithelium and no reaction in the tissues around them, are found filled with leucocytes, these evidently having come from a focus higher up. A few typical casts are also found in the tubules of the pyramid. These are darker and more compact than the material in the tubules composed of degenerated epithelium, but seemed to be the same material derived from the hyaline degeneration of the cells which had become more compact in its passage along the tubules.

As we pass from the centre of one of the nodules towards the periphery the number of leucocytes gradually give place to the round granulation cells. At first these are found mingled with the leucocytes, but a little further out the cells are entirely of this character. They become less numerous, and finally the intertubular tissue is of the ordinary width and appearance. None of these round cells are ever found within the tubules or in any position which would warrant the supposition of their origin from emigration.

The degeneration of the tubular epithelium is confined to the centre of the nodules and to the area of leucocytic infiltration. Just where the granulation tissue is most pronounced, evidence of cell division is seen in the epithelium. Among the epithelial cells in the tubules some are seen which

are larger, higher and more granular, and in these every stage of cell division can be seen. In some of the tubules this cell division has gone on until there is a double row or more of epithelial cells. In other cases the number of nuclei seem to be increased without any increased formation of cells. Generally there is no evidence of degeneration where the nuclear figures are found, but occasionally they are found along with slight degeneration of some of the cells in the neighbourhood. The cell division did not seem to take place by preference in any sort of tubules. They were found in the convoluted tubules, in the tubules of Henle, and in the smaller collecting tubules. In the examination of a great many sections a few nuclear figures were found not connected with the nodules.

Nuclear figures were also found in the granulation tissue, but in much smaller numbers, and here principally in the periphery, where the cells were not so crowded together. When found they were always seen in the walls of the small veins and capillaries. So far as one could judge from the examination of the sections, the cells of the granulation tissue appeared to be derived exclusively from the proliferations of the cells of the blood-vessels.

The glomeruli are unaltered, or when affected the change in them is of a passive character. In no place did they form the centre from which the various lesions extended. The capillaries are well preserved, they fill up the capsular space, and the zone of coagulated albumen in the capsular space which forms such a characteristic feature of most forms of Bright's disease is absent. When a glomerulus is included in the central zone where the process is most intense, there are large numbers of leucocytes in the space between the vessels and the capsule. It can be clearly seen that these do not come from the capillaries of the glomerulus, but wander in through the capsule. The capillaries are compressed and crowded together, and the capsular space is filled with leucocytes, which are also seen in every stage of passage through the capsule. Such glomeruli present some similarity to the changes in scarlet fever, but the character of the cells forming the crescents is different. No leucocytes were found between the glomerular capillaries or in the act of passing from these. Where the glomerulus is found in the granulation tissue zone, changes are found in it of the same nature as in the surrounding tissue. The capsule is frequently considerably thickened, and there is an increase in the number of cells. In most cases there seems to be some increase in

the glomerular epithelium. In one case where a glomerulus was found in a zone of granulation tissue, with numerous nuclear figures both in the tubular epithelium and in the interstitial tissue, two nuclear figures were found in the glomerular epithelium.

The only changes which were found in the kidney outside of the nodules was an infiltration with granulation cells around some of the larger veins.

The relations of the bacteria to the lesions were studied on sections made after hardening the tissue in alcohol. They were only found in the immediate centre of the nodules. They were never diffusely scattered in the tissue, but were found in large masses in the tubules. Sometimes the epithelium had entirely disappeared, the bacilli filling up the entire tubule. Sometimes along with the bacilli granular material resulting from the degeneration of the cells was found. In places the masses of bacilli were not so dense, the epithelial cells were partly preserved and contained large numbers of bacilli. Numerous leucocytes were found in such tubules, both in the epithelium and in the lumen. In one nodule the epithelium was raised from the membrana propria and converted into a solid mass which contained and was surrounded by bacilli. No bacilli were ever found in the tissue outside of the tubules nor in the glomeruli; they were always associated with necrosis and active destruction of the epithelium. There was nothing characteristic about the form, size or arrangement of the bacilli. They were short, oval rods, their length about one-third more than the width. They were cultivated from the tissues and grew readily in the Esmarch tubes and on agar. No inoculation experiments were made.

From our study of this case it is seen that we have here a disease of the kidney produced by a bacillus. It is a definite focal disease, the bacilli are only found in the foci, and are associated with necrosis and intense degeneration of epithelium. No lesions are found in the kidney outside of the foci. The foci are composed of a central area of bacilli, degenerated epithelium and pus cells. The degeneration of the epithelium extends beyond the immediate contact with the bacilli. Outside of this central area there is an area of granulation tissue which appears to be produced by proliferation of the cells of the blood-vessels. In this area ther multiplication of the epithelial cells. There does not seem to be much, if any, tendency for the tissue infiltrated with leucocytes to break down and thus form definite abscesses.

It seems most probable, from the absence of the bacilli and active changes in the glomeruli, that the bacilli have entered the kidney from the urinary passages, though it cannot be said definitely. It is probable that the disease was not associated with the presence of albumen in the urine.

SUMMARY OF FURTHER REPORT ON SURRA.

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(*Continued from p.* 258.)

IV.

Dog Surra.

A.—*Primary Investigation.*

During the first half of 1891, several English fox-hounds from the Bombay pack were kept under observation at the Laboratory. The symptoms noted were: Paroxysmal fever, temperature running up to 106·5° F., accompanied by the the usual symptoms of fever; in some few cases opacity of the cornea, and extravasation of blood into the anterior chamber of the eye supervened late in the course of the disease. The blood was microscopically examined daily, but the Surra hæmatozoon was not discovered.

2. Early in 1893 I went to the kennels at Bandora in order to investigate on the spot an outbreak of disease, which was carrying off several English fox-hounds.

3. The symptoms noted in their sequence were: Paroxysmal fever; anorexia; at a later date swelling of the integument about the head and throat; injection of the conjunctival membranes; increased lachrymation; effusion into the joints in some cases, and marked œdema of the limbs and under-surface of the abdomen; extravasations of blood into one or both anterior chambers of the eyes, followed by opacity of the cornea; and later total blindness.

4. On microscopical examination, the hæmatozoon, resembling that found in the horse—the subject of Surra—was discovered in the blood during the paroxysms, and in the fluid of the anterior chamber of the eye, when an extravasation of blood was present, although the organisms were absent during the same period from the general circulation.

5. English imported dogs, fox-hounds and fox-terriers, have been found to be the most commonly affected with this disease during the first few years' residence in this country.

B.—*History of previous outbreaks.*

This disease was unrecognised as Surra until the outbreak of 1893. The first records of heavy mortality in imported fox-hounds are those of the Ootacamund kennels in 1869-70. From 1870—1883 there was no mortality in the Madras packs. But in 1884, fourteen couples succumbed to symptoms similar to those described as attacking the Bombay hounds, viz., paroxysmal fever, &c.

2. On the 11th November, 1892, a pack of fresh English hounds arrived in Bombay, and were placed in kennels some ten miles out of the city. The first animal was taken ill on 11th December, 1892, and died on the 10th January, 1893; and some 20 succumbed during the three months following.

3. Five dogs (four hounds and one fox-terrier) were bitten by a hyæna during a run on the 8th January, 1893. All the five went blind between the 7th and 26th March (the 58th and 77th days), and their several deaths took place between the 12th March and 16th April (63rd to 98th day following the bite). The animals hunted were foxes, jackals, and hyænas. One hound, which absolutely refused to join in the kills, remained in perfect health, and is now alive (July, 1894).

4. Probably some jackals and foxes suffer from Surra; for in 1893, several of the former appeared incapable of running far, and when put up by the hounds, were caught within ten minutes, their bodies being afterwards devoured. A certain amount of carrion was picked up by the hounds during their runs; and one animal left the pack and returned to the kennels during the following night, gorged with carrion. This animal was the first to present Surra symptoms, and died after an illness lasting 31 days.

5. In February, 1894, Surra broke out in the Mhow pack; and several hounds—after microscopical examination of their blood for diagnostic purposes—were shot. The remainder of the pack were then sent down to Bombay on 15th February, and shipped the same evening to Calicut, *en route* for Ootacamund. Two of them, however, died of Surra on their way from Bombay; the rest survived.

6. *Pathological Lesions:*

Lungs.—Subpleural extravasations, sometimes localized consolidation.

Spleen.—Much enlarged; numerous subcapsular petechiæ.
Kidneys.—Petechiated.

C.—*Inoculation.*

The hæmatazoon of the dog produces Surra when inoculated into the Horse; and the disease is characterized by well-marked relapses in the temperature at the termination of the paroxysms.

D.—*Treatment.*

Few cases have been submitted to experimental treatment; but, as in the case of the horse, arsenic and mercury appear to be the only remedies which promise success.

V.

Hæmatozoon of Fish.

A.—*Previous Observations.*

Mitrophanow described the presence of hæmatozoa in two kinds of fish examined by him in Russia—in mud fish (Cobitis fossilis), and in the carp (Carrassius vulgaris ?)

2. I have examined numerous species of fish from the Mutha-Mulla River (Poona), and found organisms resembling the Surra hæmatozoon in the blood of *Rhynchobdella aculeata* (Day), *Bâum* (Hind.), *Warm* (Mahratti), and *Barbus carnaticus* (Day). These organisms were present in greatest numbers during the hottest months of the year. Although similar in shape to the Surra hæmatozoon, they were of three distinct sizes, and evidently different varieties of the same species.

B. Horses, guinea-pigs, field rats (*Nesokia providens*) proved refractory when inoculated with the soiled blood, but this may have been due to the very small quantity obtainable from the circulation of fish, or more probably to the direct injection of an organism taken from a cold-blooded animal (temperature of surrounding water) into a warm-blooded animal (temperature above 98·5° F.)

P. Mitrophanow.—Neue monadenformige Parasiten des Fischbluts. Biologisches Centralblatt. Band III. 15 März, 1883, page 35.

VI.

Summary of our Knowledge of the Etiology of Surra up to the Present.

The disease occurs spontaneously in: Elephants, camels, solipeds, bovines, and the canine species (dog, jackal, hyæna).

2. In most of these animals the disease appears between June and December, *i.e.*, the rainy season, while in hounds it occurs during the hunting months, January to the end of March.

3. The causes of the disease in animals other than canines are:

(*a*) Drinking water concentrated by evaporation, and contaminated with the infusorian, towards the end of the hot season.

(*b*) Eating soiled herbage obtained from localities liable to inundation.

(*c*) Ingestion with corn, of excrement of rats and bandicoots, affected with the hæmatozoon.

(*d*) In hounds, by eating carrion or the soiled blood of animals hunted; in other dogs, by destroying affected rats and bandicoots.

4. In the case of horses contracting the disease, there can be little doubt that many of the outbreaks are due to the ingestion of rats' or bandicoots' excrement with corn. In the hot season, the hæmatozoon or its resting form in the excrement would naturally be destroyed by the continued drought; while in the rains, the moisture would be found sufficient to sustain the life of the infusorian, and enable the resting form to germinate, and possibly mature *in situ*.

5. Hence the dung of rats and bandicoots is a source of danger; and protective measures should therefore be taken at all times to remove rat and bandicoot excrement from the corn given to equines.

6. As, however, the complete removal of the excrement would be a matter of some difficulty owing to its breaking into fragments, artificial means to promote the desiccation of the corn, and the consequent destruction of the organism or spores, should be adopted. This would perhaps seem the most rational preventive measure, as the prolonged drought during the hot season appears to produce the same effect.

7. The accompanying table (III.) bears out the above remarks, and was drawn up from particulars kindly furnished by the Bombay Tramway Company.

8. It will be observed that in 1893, the rainfall of May was unusually high, in this respect entirely differing from the five preceding years; the disease also broke out nearly two months earlier than usual. This may be accounted for, according to our theory, by the hæmatozoon or its resting-form not only escaping the usual dry heat of May, and thereby loss of vitality or even destruction, but its power also

of reproducing the disease would be increased by the earlier rainfall, and the outbreak of Surra thus occur sooner.

TABLE III.

Showing the Monthly Rainfall in Bombay for the years 1888—1893, *with the dates* of Surra outbreaks, and number of Horses attacked in each year at the Bombay Tramway Company's Stables.*

Months.	1888.	1889.	1890.	1891.	1892.	1893.	Remarks.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	
January	1·85	0·00	0·00	0·00	0·00	0·00	
February	0·02	0·00	0·00	0·00	0·00	0·14	
March	0·10	0·00	0·00	0·20	0·00	0·00	
April	0·00	0·00	0·01	0·00	0·00	0·02	
May	0·00	0·67	0·06	0·00	0·11	6·30	
June	15·76	19·89	24·55	13·99	13·30	21·47	Three horses attacked 20th July 1893, 1 Australian, 1 Arab, 1 Persian.
July	22·47	30·45	21·34	32·48	23·86	*(20th) 16·14	
August	11·43	10·32	10·61	6·94	36·56	13·57	
September	4·92	*(14th) 2·71 } 6·45		* (13th 22·53	*(12th) 18·73 } 7·52		
October	*(18th) 0·11 } 3·80		* (6th) 0·58 } 1·04		1·89	0·45	
November	1·16	0·00	1·25	0·00	0·67	1·63	
December	0·00	0·00	0·13	0·00	0·00	0·22	
Total Rainfall for year	57·82	67·84	64·98	77·18	95·12	67·46	
Total Rainfall from May 1st to date of outbreak of Surra	54·69	61·97	63·56	66·50	84·87	39·41	
No. of Horses attacked in each year	14	47	2	1	15	11	

N.B.—The stables are supplied with water from the Municipal Reservoirs of Vehár and Tánsa, and the hay is grown on black soil in Gujarát.

RABIES IN SOUTH AFRICA.

REFERENCE has been frequently made within the past year to the existence of rabies in dogs in South Africa, and more especially at Port Elizabeth, Cape Colony. Doubts as to the exact nature of the disease have been dispelled by the publication of a report from the Bacteriological Institute, Graham's Town, on the condition of a dog sent there from Port Elizabeth; this report is signed by Dr. Black, Acting Colonial Bacteriologist, and W. Pye, M.R.C.V.S., Veterinary Assistant, Bacteriological Department.

Report of Post-Mortem Examination of Dog Dead of Rabies.

The animal, a well-nourished fox-terrier, arrived at the Bacteriological Institute from Port Elizabeth in charge of Mr. Britton, M.R.C.V.S., of Port Elizabeth, on August 9th, 1894, at 7 a.m. It was then lying in a semi-comatose condition in its cage, and it was evident that the lower jaw was paralysed. Shortly before 8 o'clock a.m. it was heard to scream, and on being then examined it was found that death had taken place exactly an hour after arrival. Cadaveric rigidity set in with surprising rapidity, and was universally present within half-an-hour from the moment of death.

Post-mortem examination, 10 a.m., two hours after death:—Body generally well nourished and showing no marks of injury of any kind whatever. *Rigor mortis* universally present. The lower jaw was drooping, the fangs were exposed, and the mouth filled with straw and refuse. The muscles, on opening the body, were seen to be darker than normal; the blood was very dark and had its coagulability retarded. The soft palate, the pharynx, the epiglottis, the larynx, and the trachea all showed on their mucous membrane a condition of patchy congestion. The sublingual, parotid, and cervical glands were all enlarged and congested. Both lungs were congested. The heart, beyond some engorgement of the coronary veins, was normal. The stomach contained a varied assortment of refuse matter principally consisting of tin-foil chewed into hard lumps, the capsules of beer bottles, straw, pieces of wood and other rubbish, but no food. The mucous membrane was congested, and also showed extensive patchy hæmorrhagic extravasations. The duodenum and jejunum showed a similar condition, which became less marked as progress was made towards the ileum. Their mucous membrane was also covered with a slimy, bile-stained covering of mucus. The large intestine and rectum were

almost empty. The liver was in a condition of slight patchy congestion. The spleen was also congested. Both kidneys were markedly congested and dark in colour. The bladder was firmly contracted and empty, the veins on its peritoneal surface were engorged, and the mucous membrane was congested, and showed a few faint petechiæ.

On opening the cranium slight engorgement was visible in the vessels of the pia mater on the upper surface of the cerebral hemisphere. The vessels at the base of the brain were highly congested, as also was the dura mater lining the middle and posterior fossæ of the cranium. Into the subarachnoid spaces at the base of the brain there was a considerable amount of fluid effused. The brain substance itself was greatly softened. The medulla and pons Varolii were also softened, and their vessels congested. An extravasated blood clot was formed on the right side of the medulla over the roots of the 11th and 12th cranial nerves. There was effusion of blood into the 4th ventricle, and the choroid plexus was congested.

All these pathological conditions were most characteristic of rabies, and its diagnosis, therefore, clear.

From the spinal cord of the affected dog an emulsion was made. This was injected into the cranial cavity of two rabbits, one of which died of rabies a few days afterwards, the other being under observation when the telegram announcing the fatal termination was despatched.

THE VIRULENCE OF TUBERCULOUS FLESH.

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(*Continued from page* 235.)

McFADYEAN* submitted 14 guinea-pigs and 6 rabbits to the ingestion of the juice of flesh from cattle affected with generalised tuberculosis. This juice, which had been prepared in the same way as that for the inoculation experiments, was given to the animals in dishes which had been previously sterilised, mixed with bread crumb. *One* guinea-pig ingested 10 cubic centigrammes of juice, *five* received 20 cubic centigrammes each, *two* received 50 cubic centigrammes each, *five* received 60 cubic centigrammes each, and *one* got 70 cubic centigrammes. *Four* rabbits got 20 cubic centigrammes each, and *two* others received 15 cubic centigrammes

* "Report of the Veterinary Department for 1890," p. 13.

each during four days, amounting to 60 cubic centimetres each.

Four of the guinea-pigs and four of the rabbits were also inoculated subcutaneously or intraperitoneally with the same juice.

When killed and examined, *none of the animals showed a trace of tubercle.*

Perroncito* fed two six-months-old pigs for four months with the flesh of tuberculous bovines, but found no evidence of tubercle in them when they were killed.

"A family of twelve pigs, two months old, were fed for five months with tuberculous flesh. Some of them died from various diseases, and the others were killed at different times, but no tubercular lesion was discovered. Two young Yorkshire pigs received the same kind of alimentation for three months without becoming infected."

Galtier† fed four dogs, a cat, and two fowls, at numerous times, with flesh from sixteen tuberculous animals. None were infected.

In four other experiments, guinea-pigs consumed the same kind of flesh with impunity.

A calf, aged six weeks, consumed four kilogrammes of flesh from tuberculous bovines at four feeds; another, aged between four and five months, had three similar meals. Neither of them became tuberculous. Two pigs from five to six months old, ingested at different times ten kilogrammes of flesh that had been seized but was not infected.

The experiments of Loucachevitch‡ were carried out on four cats and two dogs, all adults, and which were fed during from *two* to *four* months on flesh from tuberculous animals. When killed all these creatures were found to be free from tuberculosis with the exception of a cat, which had been fed with the flesh for four months and remained in excellent condition, having increased 24·3 per cent. in weight. No particular lesion was found in the intestines, and there was a small abscess, *but no bacilli*, in the mesenteric glands; but bacilli were found on the mucous membrane of the bronchi and in the lungs.

It is difficult to explain how, with such results before him, Loucachevitch could arrive at the definite conclusion that tuberculous flesh is noxious.

* Perroncito. *Loc cit.*

†Galtier.—"Recherches sur la Virulence de la Viande des Animaux Tuberculeux." *Journal de Méd. Vétérinaire*, 1891, p. 1. "Dangers des Viandes d'Animaux Tuberculeux," *Ibid*, 1892, p. 460.

‡ Loucachevitch.—*Loc. cit.*, p. 13.

Taken altogether, and apart from all criticism, the preceding results show that the infectiveness of flesh from tuberculous animals is quite exceptional, and that in the great majority of cases its virulence cannot be revealed by the most severe methods that can be adopted for experimental transmission.

In experimenting on the guinea-pig—an extremely sensitive reagent—Nocard only obtained one positive result in fifty-five intraperitoneal injections; in twenty-six inoculated, Chauveau and Arloing obtained two positive results; Galtier succeeded in infecting four of sixteen inoculated animals; but Kastner with sixteen guinea-pigs, McFadyean with eleven, and Perroncito with more than two hundred, did not succeed in infecting any.

An analysis of some of the positive results now given, enables us to estimate in a more precise manner the degree of virulence the muscles possess. In Nocard's experiment, a guinea-pig was infected, while three others inoculated at the same time with the same material remained completely immune. The two animals infected by Chauveau and Arloing, belonged to a series of twenty guinea-pigs inoculated with the same flesh-juice, on eighteen of which it had no effect. Thus, *the very exceptional infectiousness of the muscles is only made exceptionally appreciable by inoculation of the guinea-pig—that is by the most certain test of virulence that can be resorted to.*

If the effects of the ingestion of flesh from tuberculous animals are alone considered, it will be observed that infection is scarcely ever realised, and that the few positive results reported have been obtained under such conditions that their signification remains at least doubtful. It is also necessary to remark that the experiments of Gerlach, so frequently invoked, have been very inexactly interpreted; they merely show that three young pigs out of seven were infected, and that nine rabbits remained unaffected. The pigs had ingested five kilogrammes of raw flesh; besides, in all the experiments one of every two pigs escaped the contagion. On the other hand, it is remarkable that the only positive results have been obtained by experimentalists who give no evidence of having adopted any precautions to prevent the flesh from being soiled or free from tubercular lesions. The influence of this source of error clearly appears in the English experiments at Harrow, and there can scarcely be any doubt that those of Denham were conducted in the same manner. On the other hand, all the investigations in which

the necessary precautions were taken, have yielded entirely negative results.

So that for the present it is correct to state that *there has not been a trustworthy experiment to prove that the ingestion of flesh from tuberculous animals is capable of producing tuberculosis.*

II. Sheep.

Ingestion.

Gerlach* relates the following experiments:

Experiment 54.—*A pig*, aged four months, was fed for three days with the flesh of two sheep affected with *generalised tuberculosis*, after ingestion of the tuberculous lymphatic glands of a cow. The pig coughed frequently for a month, but otherwise it seemed to be healthy. It was killed at the end of a hundred-and-forty-days, when caseous foci were found in the mediastinal glands and miliary tubercles in the lungs.

Experiment 55.—*A pig*, four months old, was fed like the preceding. When killed at the end of a hundred-and-eighty days, the carcass was fat, but there were miliary tubercles in the lungs and the pharyngeal glands.

III. Goat.

Ingestion.

A single experiment is due to Gerlach*:

Experiment 57.—*Two rabbits* received in three days five grammes of flesh from a goat, nine months old, which became affected with generalised tuberculosis, after consuming a spoonful of softened matter found in tubercles in the liver of a cow. This goat was killed when it had become *completely phthisical.* One of the rabbits died accidentally after thirty days, and the second was sacrificed after forty-seven days; both were healthy.

IV. Pig.

1.—*Inoculation.*

Toussaint† inoculated *two rabbits* with juice from the thigh muscles of a tuberculous sow. Two other rabbits received the same juice obtained from the flesh after it had been grilled. *The four rabbits became tuberculous.*

2.—*Ingestion.*

Gunther and Harms‡ caused four rabbits to ingest five grammes of raw flesh from an "extremely tuberculous" pig.

Two rabbits, killed after fourteen and sixty-five days, were quite healthy. The two others, killed after sixty-five days, showed tubercular lesions, particularly in the intestine. "The walls of the cæcum were studded with tubercles the size of a pin's head, and in the vicinity of Bauhin's valve was a mass of tubercles the size of a nut."

*Gerlach. *Loc. cit.*, p. 34.

† Toussaint. Infection par le Jus de Viande Chauffée. Acad. des Sciences, August 1st, 1881.

‡ Gunther and Harms. Versuche über Tuberkulosis. Magazin für die Gesammte Thierheilkunde, 1871, vol. xxxvii., p. 150.

Gerlach* reports an experiment :

Experiment 59.—*Four rabbits* received five grammes of the flesh of a *very tuberculous* pig. Two of them were killed in two and three months, when tubercles were found in the cæcum and at Bauhin's valve. The other two rabbits were killed after three and four months, and did not show any appearance of disease.

V. Poultry.

Peuch† tried to discover whether the flesh of a capon which had died in a state of extreme emaciation from tuberculosis. "The flesh of this capon was squeezed and a reddish juice was obtained from it ; this was inoculated beneath the skin of the ear of *three rabbits*. One received one cubic centimetre of juice, the second two, and the third three." *The three rabbits became tuberculous.*

It is interesting to compare the results obtained with the flesh of the *sheep*, the *pig*, and the *fowl*, with those resulting from the flesh of bovines. With the former virulence was the rule.

VI. Man.

A. Virulence of the Blood.

The presence of Koch's bacillus has been on several occasions observed in the blood of tuberculous people on direct bacteriological examination, most frequently made after death.

Liebmann in 1891 made 141 examinations of the blood of persons who had received injections of tuberculin, and asserts that he found the bacilli in fifty-six occasions (48 per cent. of the cases). On the contrary, numerous experimentalists who have repeated these examinations (Ewald, P. Guttmann, Cantani, Kossel, Max Stern, etc.) have had only negative results. If the presence of bacilli in the blood are sufficiently demonstrated, we cannot determine the frequency nor yet the conditions upon which infection depends.

B. Virulence of the Muscles.

Inoculation.

Gratia and Lienaux‡ have published the results of two experiments.

1. "Fragments of muscle were removed with all necessary precautions from the calf of the leg of a man who had died from pulmonary and intestinal tuberculosis at the extreme stage; they were crushed in a mortar along with a little distilled water, and yielded a rose-coloured slightly turbid

* Gerlach. *Loc. cit.*, p. 35. † Peuch. Congress on Tuberculosis, 1888, p. 75.
‡ Gratia and Lienaux. *Loc. cit.*

fluid. A gramme of this juice was injected into the peritoneal cavity of a guinea-pig. *The result of this inoculation was altogether positive.* After three months the animal was affected with generalised tuberculosis, the lesions predominating in the abdomen. A bacteriological examination revealed the presence of Koch's bacillus.

2. An adult guinea-pig was inoculated in the peritoneum with a gramme of muscle-juice from a man who had died in the last stage of generalised tuberculosis. Fifty-five days afterwards the guinea-pig was killed and examined, when it was found to be affected with very extensive tuberculosis, most marked in the abdominal cavity."

Stenheil * found the muscles of nine tuberculous people constantly virulent. "In order to obtain the muscle-juice, one or two of the psoas muscles were cut into, and pieces removed along with the fat and connective-tissue surrounding them; all the aponeuroses, fat and large vessels were carefully removed, and the flesh washed as clean as possible in a stream of water. Then it was chopped up on a plate of glass, enclosed in a damp cloth and put in the press. From 100 to 200 grammes yielded 20 cubic centimetres of juice. Two guinea-pigs received each time one cubic centimetre of the juice in the abdominal cavity, the inoculation being made with a sterilised Pravaz syringe, after the surface of the abdomen had been sponged with corrosive sublimate, then with alcohol." The muscles were derived from people who had succumbed to various forms of acute, subacute, or chronic tuberculosis. In a total of nine experiments, seven yielded positive results, the fourteen inoculated guinea-pigs becoming infected.

In one experiment only one of the guinea-pigs was diseased, the second animal on being sacrificed on the thirty-second day not offering any lesion. In another attempt, the animals succumbed in five days to purulent peritonitis.

The result of these experiments demonstrates that, *in man, as with the other animal species with the exception of the bovine, virulence of the muscles is the rule.*

If an analysis of the experimental results given in these pages permits some precise conclusions to be arrived at, it also shows that there are numerous points in connection with this matter still to be elucidated.

From an *experimental* point of view, it is sufficiently established that the blood of cattle may be virulent at certain

* F. Steinheil. Ueber die Infectiositat des Fleisches bei Tuberculose. *Münch. Med. Wochenschrift*, 1890, pp. 682, 706.

periods in the acute forms of the disease (Bang), as well as in the chronic (Galtier, Hagemann); and the virulence of it also entails the virulence of the muscles, which always retain a certain quantity of that fluid.

The blood and muscle none the less constitute eminently unfavourable media for the tubercle bacillus. Nocard* has shown by experiments that after inoculation with large doses of virus into the veins of rabbits, the virulence of the blood has disappeared in less than four hours. McFadyean† has found the blood of the horse to be innocuous in twenty-four, twenty-nine, and forty-eight hours after the injection of a virulent culture into the jugular. Nocard's investigations also establish the fact that the virulence of muscles disappears in four to six days after virulent intravenous inoculation; while those of McFadyean show that, in the same conditions, the muscles of the horse are free from the virus in less than ten days. It is therefore demonstrated that the bacilli, when dispersed in the blood vessels, are destroyed *sur place* at the muscles, probably without having passed the endothelial barriers.

In the course of the tubercular evolution, the bacilli will find their way into the circulation, but in the blood and muscle they will undergo such extreme dilution that it must be difficult to detect their presence.

According to the results made known, there exist capital differences in the virulence of the muscles, according to the species of the animals; for while the muscles of bovines are not always virulent, those of the sheep, pig and man are nearly always so. It would be interesting, however, to control these latter results, which are not sufficiently established.

From a hygienic point of view, the information furnished by experimentation has a very definite signification. So far as tuberculous bovine animals are concerned, the muscles only very exceptionally contain the virus; this is found in such a state of dilution that infection is only obtained by *inoculation*, and then only in certain of the inoculated. We have seen, on the other hand, that the dangers of *ingestion* are *nil* in all kinds of animals.

Nevertheless, the question of danger from the consumption of tuberculous flesh is not entirely solved by these observations. If the muscular tissue is not virulent, the portions sold for food may be contaminated by virulent matters with

* Nocard. First Congress on Tuberculosis, 1888, p. 55.
† McFadyean. *Journal of Comparative Pathology and Therapeutics*, 1892, p. 23.

which they have been brought into contact, while they may also contain disseminated masses of tubercle.

In reality, the superficial soiling of these pieces is not much to be dreaded, and sterilisation is assured by the most summary scorching or the most simple cooking. Besides, the exposed surfaces are very limited in extent, while the flesh of healthy animals is exposed to the same chances of soiling by the hands or the knife of the butcher.

On the other hand, the presence of small masses of tubercle adhering to the serous membranes or disseminated in the intermuscular lymphatic system, constitutes a source of real danger, which alone would necessitate a sanitary inspection of all animals intended for food.

To resume: *The flesh of tuberculous bovines may, in certain cases, offer some danger. But it is very exceptional that there is any danger, and in such cases this is not great.*

These conclusions are those which were unsuccessfully maintained by Nocard at the Congress of 1888, and they are also those formulated by Bollinger, Galtier, McFadyean, and Perroncito.

The French law, which enacts seizure in every case of very extensive tuberculosis, therefore satisfies the most timid. But it would be well to attenuate the danger still more by only allowing the consumption of such flesh after it had been completely sterilised by heat.

The same formulæ cannot, *a priori*, be extended to animals of other species. Does tuberculosis in the pig, which is far from being rare, really offer the dangers that certain experiments would seem to imply? The solution of this question is all the more important, inasmuch as the blood or flesh of the pig is often consumed raw, and this animal is not under the supervision of the sanitary law.

REMARKS ON HOG CHOLERA AND SWINE PLAGUE.*

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(Continued from page 244.)

IN many German publications the hog-cholera bacillus is placed under the group of bacteria belonging to the so-called hæmorrhagic septicæmias. Elaborate studies have been

* Read at the First International Veterinary Congress of America, held in Chicago, Ill., in October, 1893.

made in German laboratories, showing that the hog-cholera bacillus is not identical with the Schweine-seuche bacillus, which is a member of the hæmorrhagic septicæmia group. There never was any good reason to suppose that it could be identical with the latter bacillus, and the amount of labour given to repeatedly demonstrating this evident fact, sufficiently familiar to us since 1888, has been a source of surprise to American investigators (with the possible exception of F. Billings) who were acquainted with the hog-cholera bacillus on the one hand and the various bacteria of the hæmorrhagic septicæmic group on the other hand. We consider that the hog-cholera bacillus bears more resemblance to the typhoid and colon groups of bacteria (although nothing would be gained by classifying it with either group) than to the hæmorrhagic septicæmia group, and that it is misleading to place it in the latter group, where the swine-plague bacillus, the Schweine-seuche bacillus, the Wild-seuche bacillus, etc., belong.

As regards the distribution and recognition of the hog-cholera bacillus in the natural disease in swine, there are certain points which we wish to emphasise. Although in ordinary cases of hog cholera there is no difficulty in recognizing the presence of the hog-cholera bacillus, cases occur in which the determination of the presence of this bacillus is difficult, and there are chronic cases with typical lesions of hog cholera, and cases even with apparently fresh lesions, in which the most complete bacteriological examination fails to reveal the presence of this micro-organism.

In one of our cases we demonstrated hog-cholera bacilli in abundance in the intestine, which was the seat of rather superficial small buttons and of fresh diphtheritis, and found only a single colony of the hog-cholera bacillus in the roll culture from the liver, and a very few colonies in the culture from the peritoneum. Cultures inoculated with abundant material from the spleen, blood, lungs, and kidney contained no colonies of this bacillus, and a rabbit inoculated with the spleen survived. This case shows that the bacteriological examination of the intestine in hog cholera, difficult as it is, should not be neglected, and that without such examination the presence of hog-cholera bacilli may be overlooked. In several similar cases with intestinal lesions typical of hog cholera, swine-plague bacilli were present in the lungs and likewise sometimes in other parts. The danger of mistaking such cases for pure swine-plague infection, so far as can be determined by bacteriological examination, is apparent.

We have evidence that the hog-cholera bacillus may have entirely disappeared from the body, so far as can be determined by cultures and inoculation of animals from the various organs of the body, including the intestine, at a period when characteristic intestinal lesions are still present. This evidence rests upon the study of herds in which we have found pigs dead of hog cholera with hog-cholera bacilli, and later have examined, without finding these bacilli, pigs from the same herd, with similar intestinal lesions—some evidently undergoing repair, others still typical buttons.

Pigs in which the intestinal lesions of hog cholera persist after the disappearance of the hog-cholera bacilli may be infected also with swine plague. We interpret thus cases in which the most typical intestinal lesions of hog-cholera—that is, perfectly characteristic buttons—are present, and still the bacteriological examination shows the presence of only swine-plague bacilli. We have observed whole herds in which the affection was of this character. These buttons we regard as characteristic of hog-cholera—as much so as typhoid ulcers are of typhoid fever. We possess convincing experimental proof that these buttons are caused by the hog-cholera bacillus, and there is no evidence that the swine-plague bacillus or any other species of micro-organism is capable of producing them.* In the present state of our knowledge we consider that whenever typical buttons are present the inference is justifiable that the hog-cholera bacillus has been active in the case, whether or not it be demonstrable at the time of autopsy. There is no difficulty in understanding how such necrotic lesions, when extensive, may lead to the death of the pig, even after the specific germ has died out. In most, but not all, of these fatal chronic cases with lesions characteristic of hog cholera, but without the hog-cholera bacillus, there is concurrent or secondary infection with another micro-organism, most frequently with the swine-plague bacillus, and the death of the animal may be attributed in part or wholly to this other infection.

Characteristic buttons are by no means present in all cases of hog cholera, not even in all chronic cases. We possess

* An exception would be made to this statement if the recently-published view of Bang were confirmed, that still a third bacterium, which he calls the necrosis bacillus, is concerned in the natural disease designated hog cholera or swine pest. The deeper necroses, that is, the buttons, he attributes to the invasion of this necrosis bacillus after the way has been prepared for it by a superficial croupous inflammation set up by the hog-cholera bacillus. Our experiments, however, show that the hog-cholera bacillus may cause these buttons, and we cannot, therefore, accept with the present evidence a second micro-organism as the cause of such peculiar and typical lesions. We are acquainted with Bang's article only by the abstract in the "Centralblatt für Bakteriologie," 1893, Bd. XIII., p. 203.

evidence similar to that already mentioned, based upon the examination of previous or concurrent cases of hog cholera in the herd, that pigs may die with forms of intestinal necrosis which cannot properly be called buttons, and even with simple intestinal diphtheritis after the hog-cholera bacilli have disappeared, or at least are no longer demonstrable by culture or inoculation of animals, although they had been demonstrated previously in cases with similar lesions in the same herd. Such observations, with negative bacteriological results, might be interpreted as opposed to the acceptance of the hog-cholera bacillus as the cause of hog cholera, were it not for the conclusive experimental demonstration of the causative rôle of this bacillus.

In view of the facts which have been mentioned, it is clear that great caution should be exercised in the interpretation of cases in which the bacteriological examination reveals only the swine-plague bacillus, although the intestinal lesion of hog cholera are present. Until there is experimental evidence that the swine-plague bacillus can produce such lesions, it is not warrantable to refer them to the presence of this organism.

In a number of cases we have isolated hog-cholera bacilli of varying degrees of attenuation of virulence. The attenuated form most frequently met is one which fails to kill rabbits by subcutaneous inoculation, but is fatal after intra-venous inoculation with the characteristic lesions produced by the virulent bacillus, but with a greater tendency by this method of inoculation to cause intestinal hæmorrhages, necrosis, and diphtheritis in rabbits. Similar observations have been made by Theobald Smith. These intestinal lesions in rabbits and guinea-pigs are not, however, extremely infrequent after intra-venous, and they may occur after subcutaneous inoculation, and often after ingestion of virulent hog-cholera bacilli. We have also met bacilli with all essential morphological and cultural characters of the hog-cholera bacillus, but incapable of killing either rabbits or mice, at least in ordinary doses. We have succeeded in causing intestinal diphtheritis with necroses by feeding swine cultures of partly attenuated hog-cholera bacilli, although the pigs have usually recovered. These observations are of importance with reference to the question of identity of the hog-cholera bacillus and the swine-pest bacillus, as will be explained later.

As we have found in the same pig both virulent and attenuated hog-cholera bacilli, it is probable that the hog-cholera bacillus may suffer loss of virulence in the body of swine affected with hog cholera. It is not necessary to

assume that the degree of virulence found at autopsy is identical with that possessed by the bacillus at the time of invasion of the animal.

In several instances the subcutaneous inoculation of rabbits with necrotic intestinal buttons has not proven fatal, even when the inoculation with the spleen and other organs of the same pig has caused fatal hog cholera in rabbits. This would indicate that the hog-cholera bacilli were no longer present in the buttons, or, if present, were, in contrast with those in the spleen and other internal organs, so weakened in virulence as not to be fatal to rabbits by subcutaneous inoculation, or that the mixture with intestinal bacteria prevented the usual manifestation of their pathogenic activity. The last supposition we consider improbable, as often, indeed usually, the inoculation of rabbits with the fresh intestinal lesions of uncomplicated hog cholera causes death, with the usual lesions and presence of hog-cholera bacilli in the rabbit. In the combined infection with hog cholera and swine plague the inoculation of rabbits with pieces of the intestine is likely to produce swine plague.

In our experience there has been considerable similarity in the results of the bacteriological examination of the different pigs of the same herd, whether affected with pure hog cholera or with hog cholera combined with swine plague ; but there are so many exceptions to this that it is hardly proper to set up any rule on this point.

Often in hog cholera there may be invasion of other bacteria than that mentioned. The most frequent of these secondary invaders (excluding the swine-plague bacillus) has been in our experience the bacillus coli communis, which may, without sufficiently careful examination, be mistaken for the hog-cholera bacillus, which morphologically, and even in many of its cultural properties, is not so unlike the colon baciilus. As has been shown by one of us (Welch*), intestinal lesions such as those present in hog cholera favour the invasion into internal organs of the bacilli coli communis.

We will now consider briefly the experimental evidence that the hog-cholera bacillus is really the cause of hog cholera. Although the bacteriological study of the natural disease speaks decidedly for the hog-cholera bacillus as the cause of the disease. there are such difficulties in this study, and so many complicating factors, that a reasonable scepticism is warranted until the conclusive experimental demon-

* Welch : The Bacillus Coli Communis ; " the Conditions of its Invasion of the Human Body and its Pathogenic Properties," *The Medical News*, December 12, 1891.

stration is brought that the hog-cholera bacillus, when inoculated in pure culture into healthy swine, is capable of reproducing the disease as it is observed under natural conditions. Above all, it should be demanded that the typical button-like lesions are reproduced. The production of simple intestinal diphtheritis, with which previous experimenters seem to have been content, is a lesion which may be caused experimentally in animals by various micro-organisms, as well as by irritant substances, and cannot be considered a satisfactory reproduction of the natural disease in its most characteristic feature, although it is true that the natural disease occurs with diffuse intestinal diphtheritis as the only intestinal lesion.

It is not clear to us that other investigators have succeeded under proper precautions in reproducing these buttons experimentally, and this gap in the experimental evidence we are able to fill.

We shall not discuss here our experiments upon rabbits, mice, guinea-pigs, and pigeons, interesting as are the lesions produced in these animals by the hog-cholera bacillus.

We have adopted every precaution to avoid error in the experiments on swine, and we consider that without such precaution experiments on swine with the hog-cholera bacillus in regions where the natural disease prevails are of little value. We have purchased the experimental pigs from places where disease was not present and had not been known to occur, and from persons who raised their own pigs, not purchasing from others. We soon found that the dangers of accidental infection with hog cholera in the Pathological Laboratory of the Johns Hopkins University, where we made autopsies on the natural disease, were such that we abandoned such experiments there, and erected pens or kept boxes in clean stables and other places where there was no possibility of infection of the locality, and we frequently shifted from place to place in making the series of experiments. Every precaution was taken to guard against accidental infection in feeding or in other ways, and in this we were usually successful. We consider it necessary to reserve as control animals pigs selected from the same lot used for the experiment, and to keep the control pigs under the same external conditions and in the same locality, but, of course, in separate boxes or pens, with the animals experimented upon. Onr early experience in buying pigs brought by rail or boat to the city, and in not being minutely careful to avoid accidental infection, led us soon to realise the importance of

these painstaking precautions, tedious and expensive as they often were. We felt obliged to reject not a few experiments in which the control pigs were found affected; but we have records of a large number of experiments in which the control pigs were healthy, the utmost caution was observed, and which we believe will stand the most rigid scrutiny.

Time will not permit on this occasion to give more than a general statement of our results, the details of which we expect to publish later.

We have succeeded, by inoculation of pure cultures of the hog-cholera bacillus, in reproducing experimentally in pigs every lesion of the natural disease, including necrotic buttons in the intestine and in all of the other situations mentioned above in describing the situation of such necroses, pneumonia, hepatic necroses, hyaline thrombosis of renal vessels, ecchymoses, etc.

It is hardly necessary to say that our experimental cases were subjected to careful bacteriological examination, and that in the successful cases the hog-cholera bacilli were demonstrated in pure culture.

Subcutaneous inoculation of swine with cultures of the hog-cholera bacillus usually produces a local inflammation with necrosis and sequestration of the inflamed tissues in which the virulent bacilli may persist for months. The animals nearly always recover. Rarely in our experience this mode of inoculation produces general fatal infection with intestinal lesions, such as are observed after feeding and other modes of inoculation.

Feeding cultures of the hog-cholera bacillus produces with great regularity intestinal diphtheritis and general infection without pneumonia. Usually the animal dies after a few days up to two or three weeks, but it may recover; and such cases of recovery afford opportunity to study the reparative process in the intestine. By simply rubbing the lips of pigs with potato cultures we have produced the disease in fatal form. With or without diphtheritic inflammation of the stomach and small intestine we have usually found in these cases an extensive superficial necrosis and diphtheritic inflammation of the mucous membrane, sometimes also reaching the submucous coat of the large intestine, most diffuse near the ileo-cæcal valve and occurring in the lower part of the colon in the form of more or less circumscribed patches of necrosis, some of these circumscribed necrotic patches bear some resemblance to the buttons; but the regular, typical, round, firm, elevated buttons we have

been more successful in reproducing by intra-venous and intra-tracheal inoculations.

Intra-venous inoculations produce usually rapidly fatal forms of infection, sometimes of distinctly hæmorrhagic and septicæmic type, usually with at least some intestinal diphtheritis, but occasionally without diphtheritis. We have been so fortunate in a few cases after intra-venous injection of very small doses (0·05 c.c. bouillon culture and less) in keeping the animal alive for a longer time and in finding at autopsy typical buttons in the large intestine.

These cases, together with similar ones, as regards intestinal lesions after intra-tracheal inoculation, have enabled us to study different stages in the formation of these buttons, and we are able to say that at least some of the buttons begin as circumscribed nodular inflammatory masses in the submucosa, with, at an early stage, an overlying intact mucosa.* We have evidence also of the possibility of the buttons beginning by necrosis and inflammation of the mucous membrane and secondary involvement of the submucosa.

Intra-pulmonary inoculation through the chest-wall often produces only circumscribed inflammation and sequestration of a limited area of lung at the point of inoculation, but it may cause diffuse hepatization, with general infection and intestinal lesions.

The most successful reproduction of characteristic pneumonia, associated with typical intestinal lesions, we have obtained by intra-tracheal inoculation of bouillon cultures in moderate doses. By this method we have caused diffuse hepatisation of one-third and more of both lungs. The

* The demonstration by us that the buttons may start by nodular foci of inflammation in the submucosa, and that there may be coagulative necrosis in these submucous nodules at a period before the mucous membrane is necrotic, is a strong argument in opposition to Bang's view, mentioned in a previous foot-note, that these deep necroses are produced by his necrosis bacillus and that only the superficial diphtheritic or croupous inflammation is caused by the hog-cholera bacillus, this latter organism simply preparing the way for the penetration of the necrosis bacillus which he finds to be present now and then in the intestine of healthy pigs. We have found the hog cholera bacillus in the submucous nodules, and sometimes apparently without admixture with other micro-organisms. It must be admitted, however, that it is difficult to succeed in producing typical buttons by inoculating healthy swine with the hog-cholera bacillus.

That the hog-cholera bacillus is capable of producing extensive necroses cannot be doubted, as the result of experiments on rabbits, mice, guinea-pigs, and on swine proves. If anyone wishes to convince himself as to the power of the hog cholera bacillus to produce extensive and deep local necroses, let him inoculate the organism into the breast muscle of a pigeon. The foci of hepatic necroses found so regularly in rabbits and mice inoculated with the hog-cholera bacillus may be caused also, although less frequently, by the swine-plague bacillus and by many other bacterial species. Bangs's view that the necroses in the pneumonia caused by the swine-plague germ (he does not seem to recognize this lesion as referable to the hog-cholera bacillus) are due also to the necrosis bacillus, we also cannot accept, as necrotic pneumonias can readily be produced by intra-tracheal or intra-pulmonary inoculation of the swine-plague bacillus, and at autopsy only the swine-plague bacilli be present.

hepatisation was variegated, red, grey, white, with areas of coagulation necrosis, with exudation of fibrin and leucocytes, with thrombi in the vessels, and with interstitial exudate; in a word, pneumonia resembling forms occurring in the natural disease. In some of these cases there were no strongyles in the bronchi. The hog-cholera bacilli were present in large number and in pure culture, positively without swine-plague bacilli in the lungs and other internal organs. When, as in some of these cases, there were intestinal buttons, hepatic necroses, hyaline in the kidneys, the reproduction of the natural disease was complete.

We consider, therefore, that the evidence is now complete, more so than in any previous experiments, that the hog-cholera bacillus is the cause of hog cholera in swine. That cases of long-standing hog cholera may terminate fatally at a stage so late that the characteristic bacilli have disappeared cannot be urged in opposition to this conclusion, as we have examples enough of the extinction of pathogenic germs from lesions which they have primarily produced; and as an example particularly pertinent, we cite typhoid fever in its late stage where also death may occur from secondary infection. That many of these fatal cases of hog cholera without hog-cholera bacilli are examples of mixed and secondary infection has already been mentioned. Whenever we find the typical button-like lesions of the intestine which are peculiar to hog cholera, we consider that the case is or has been one of hog cholera whether or not at the time of autopsy living hog-cholera bacilli can be demonstrated in these lesions or elsewhere in the body.

Is the hog-cholera bacillus identical with any of the bacteria which have been found in Europe in diseases of swine? The only bacteria which come into question are the bacillus of swine fever or pneumo-enteritis in England, the bacillus of Scandinavian swine pest, and that of the French pneumo-enteritis of swine. There is not the slightest ground for supposing that the actively motile hog-cholera bacillus, with its peculiar reaction in milk cultures, its visible growth on potatoe, its characteristic effects on animals, has anything to do with the smaller, non-motile Schweine-seuche bacillus growing invisibly or not at all on potatoe, without distinctive reaction in milk cultures, and possessed of different pathogenic properties on animals.* The latter bacillus belongs to

* That so many German investigators should have thought it necessary to devote so much time and work to proving over and over again that the hog-cholera bacillus is not identical with the Schweine-seuche bacillus is due to the confusion introduced into this whole subject by the writings of F. Billings. The description of the hog-cholera bacillus

the hæmorrhagic septicæmic group, a widely distributed group, established under this name by Hueppe, for which we possess very unsatisfactory means of differentiation of its members from each other. The hog-cholera bacillus, in our judgment, should not be ranked with the members of this group.

As was stated for the first time by one of us (Welch), as the result of a comparison of cultures, in an article published in 1889, F. Billings' swine-plague bacillus is identical with the genuine hog-cholera bacillus. Without mention, and probably without knowledge of our work, Frosch and other German investigators later came to the same conclusion. Billings' designation of swine-plague bacillus for the hog-cholera bacillus has not gained currency in this country, whereas the name swine-plague bacillus has been introduced by the Bureau of Animal Industry for a totally different species of bacterium belonging to the hæmorrhagic septicæmic group. On this occasion we beg to express our thanks to F. Billings for the numerous cultures which he has sent us.

The anatomical description of the disease, swine fever (Klein's pneumo-enteritis), the Scandinavian swine pest, and at least some of the cases of the French pneumo-enteritis of swine, leaves no doubt of the pathological identity of the disease known by these names with the American hog cholera. One of us (Welch) has had the opportunity of examining specimens from cases of English swine fever and Scandinavian swine pest, and has no hesitation in pronouncing these diseases identical, so far as the lesions are concerned, with our hog cholera.

The description originally given by Klein* of the bacillus which he then considered to be the cause of the disease in England, cannot be made to apply to the hog-cholera

in the publications of the Bureau of Animal Industry and in the preliminary report by Welch, in 1889, rendered it impossible to confound the hog-cholera bacillus with the Schweine-seuche bacillus. The organisms which really need comparison are the hog-cholera bacillus and the swine-pest bacillus on the one hand, and the swine-plague bacillus and the Schweine-seuche bacillus on the other hand. It is somewhat remarkable that in an article from Baumgarten's laboratory by Racciuglia, entitled "Comparative Experimental Investigations concerning the Bacteria of the German (Löffler-Schütz) Schweine-seuche, the American Swine Plague, and the Danish Swine Pest" (by American swine plague is meant hog cholera), the only bacteria compared by personal experimental work are the Schweine-seuche bacterium and the hog-cholera bacillus, and that no mention is made of personal observations with swine-pest cultures, although such would be expected from the title of the article; and that in the subsequent article in the same volume, by Afanassieff, the only personal observation of the swine-pest bacillus recorded is that it grows, like the hog-cholera bacillus, on potatoe (Arb. a. d. Gebiete d. path. Anat. herausg. von Baumgarten, Bd. i., 1892. Both of these articles are valuable and careful bacteriological studies.

*Klein: Virchow's Archiv. Bd. xcv., 1884.

bacillus, as his bacillus was said to form spores and to resemble the hay bacillus.

In 1890 Dr. Klein was so kind as to give one of us (Welch) a culture of the bacillus which he had isolated from cases of English swine fever, and which he then regarded as the cause of swine fever. Through the kindness of Professor Brown, Principal of the Royal Veterinary College of London, and of Mr. Banham, of Cambridge, England, one of us (Welch) was permitted to study pathologically and bacteriologically cases of swine fever occurring near Cambridge, England. Professor Klein's culture and the bacillus isolated from the English cases of swine fever proved to be in all respects, including the degree of virulence, identical with our hog-cholera bacillus. A careful comparison of the English cultures with those of our hog-cholera bacillus was made, as regards morphology, cultural behaviour, and pathogenic effects, and no difference was found. Klein's present culture of the swine-fever bacillus, therefore, can hardly be the same as that which he originally described as like that of the hay bacillus, but it is the genuine hog-cholera bacillus, which, of course, forms no spores, and does not resemble the hay bacillus.

The bacillus originally cultivated by Bang from the Scandinavian swine pest, and described by Selander*, and, later, studied by other investigators†, is doubtless the hog-cholera bacillus, although it would appear to have been observed oftener in an attenuated form than has been our experience with the American hog-cholera bacillus. We have already expressed our opinion that some error crept into Selander's work with this bacillus in Pasteur's Institute, so that the bacillus which he obtained from his experiments there, and which he supposed to be the swine-pest bacillus of highly-exalted virulence, was in reality a different bacterium. We at least feel justified in calling for a repetition by others of these experiments of Selander, with the undoubted swine-pest or hog-cholera bacillus, and for an independent examination of cultures of Selander's Paris bacterium, as well as of Metchnikoff's so-called hog-cholera microbe.

In Selander's original description of the swine-pest bacillus, he speaks of its growing upon potato like the

*Selander: Centralbl. f. Bakter., 1888, Bd. iii. p. 361. This work was done under Gaffky, in the Reichsgesundheitsamt in Berlin.

†Jensen: Abstract in Baumgarten's Jahresbericht, 1889, p. 177. (Refers to Bang's investigations.) Welch: Loc. cit., 1889. Frosch: Zeitschrift f. Hygiene, 1890, Bd. ix. Caneva: Centralbl. f. Bakter. 1891, Bd. ix., p. 557. Bunzl-Federn: Ibid., 1891, Bd. ix. 787, and Arch. f. Hygiene, 1891, Bd. xii. Afanassieff: op. cit., 1892, p. 263. Bang: Loc. cit., 1892-93.

typhoid bacillus. Frosch, who worked with cultures from the same source, was unable to confirm this.* As a matter of fact, the appearance of the growth upon potato of the hog-cholera bacillus is somewhat variable, and exceptionally its growth may be scarcely visible or even invisible upon potato, so that we are inclined to the view that Selander did not make a large number of observations of potato cultures of this organism, and happened to observe the exceptional typhoid-like growth. In our preliminary report of 1889 we stated, from personal comparison of cultures, the probable identity of the hog-cholera and swine-pest bacilli.

We were so fortunate as to be supplied again, in 1890, with a culture of the swine-pest bacillus from the Hygienic Institute in Berlin. This was stated to be from the original Bang-Selander stock. Morphologically and in cultures, notably in milk cultures and on potato, we were unable to detect any significant difference between this culture and the hog-cholera cultures. The swine-pest bacillus grew on media somewhat more luxuriantly than the hog-cholera bacillus. Although pathogenic for mice, the swine-pest culture, however, failed to kill rabbits by subcutaneous inoculation, although by intra-venous inoculation it was fatal with the same lesions and distribution of the bacteria as in the case of our hog-cholera bacillus. As we have obtained from hog cholera in this country a bacillus in all respects identical with this swine-pest bacillus, and which we regard as a somewhat attenuated form of the hog-cholera bacillus, we agree with those who have found the Scandinavian swine-pest bacillus to be identical with our hog-cholera bacillus. It remains to be determined by larger experience whether the attenuated bacillus is more common in the Scandinavian cases than in the American cases. It would appear from Bang's latest study of the subject, that the bacillus isolated from chronic cases of Scandinavian swine pest is of decidedly attenuated virulence. Bang found his swine-pest bacillus from the epizootic of 1887 identical with our hog-cholera bacillus.

The culture of the swine-pest bacillus brought to the Bureau of Animal Industry in Washington by Lundgren in 1888 was stated to be devoid of virulence for mice, rabbits, and pigs. It is left undecided by Salmon and Smith whether this was an attenuated culture of the hog-cholera bacillus, or, as

*Loc. cit. It should be noted that according to Jensen's article (already cited), published in 1889, Bang distinctly denies the accuracy of this statement of Selander, and says that his swine-pest bacillus is in all respects identical with Salmon's hog-cholera bacillus. Of the subsequent investigators, only Caneva finds this typhoid-like growth of the swine-pest bacillus.

suggested by Lundgren, some other bacillus brought to this country by mistake for the genuine swine-pest germ.

Frosch (1890) concludes that Selander's swine-pest bacillus is identical with the American hog-cholera bacillus, but the only mention which he makes of inoculation of animals with the former is the statement that it possessed less virulence for guinea-pigs than was found by Selander, and less than the American hog-cholera bacillus. Selander in his original brief communication (1888) found the swine-pest bacillus virulent for mice, rabbits, and guinea-pigs, both by subcutaneous inoculation and by feeding.

Caneva found that the swine-pest bacillus (Selander) was closely allied to the American hog-cholera bacillus (Salmon), but differed from it by typhoid-like growth on potato and by absence of pathogenic effect when inoculated subcutaneously in rabbits. As we have already stated, we, as well as others, found no difference between the potato-growth of swine pest and of hog cholera, and that although the swine-pest culture in our possession was not virulent by subcutaneous inoculation of rabbits, it produced by intra-venous inoculation the same effects as the hog-cholera bacillus, with the same tendency to cause intestinal lesions in rabbits that was noted with our attenuated hog-cholera bacillus more frequently than with the virulent bacillus. The usual extensive necroses in the liver and the occasional formation of hyaline in the renal vessels were produced by this swine-pest germ as well as by the hog-cholera bacillus.

The only statement made by Afanassieff as to his study of the swine-pest bacillus is that it grows on potato like the hog-cholera bacillus. This leads Baumgarten to remark in a foot-note that by this observation of Afanassieff (it had already been made by Bang, Frosch, and others) it is established that "in all essential points complete agreement exists between these two bacteria."

As we have not had opportunity personally to study cultures from pneumo-enteritis in swine occurring in France, we shall not discuss the results of the bacteriological study of this disease published by French investigators, save to remark that different observers have evidently obtained different bacteria from these cases, and that among these bacteria can probably be recognised, although not with absolute certainty from the descriptions, the swine-plague bacillus and the hog-cholera bacillus. We have already criticised Metchnikoff's so-called hog cholera microbe, which we do not recognise as the genuine hog-cholera bacillus.

It seems to us clear that we have still to await a much more thorough and extensive bacteriological study of the natural disease which occurs in Europe, and is evidently identical with our hog cholera, than has yet been furnished us by European investigators with the exception of Bang, before a satisfactory comparison can be made between their results and those obtained in this country on the basis of a much larger experience and more thorough bacteriological work with the natural disease. We trust that such studies will be based upon complete bacteriological examinations of all of the organs of a large number of cases in different epizootics and in different localities, and in the various stages and types of the disease, as has already been done in this country, and that attention will be paid to complicating micro-organisms when present.

We have thus far considered the hog-cholera bacillus and its etiological significance. It remains to say something concerning our experience with the swine-plague bacillus about which there has been so much controversy. This bacillus, as we have repeatedly mentioned, belongs to the group of bacteria which has received from Hueppe the name of the bacteria of hæmorrhagic septicæmia. It is a totally different species from the hog-cholera bacillus. Its characters were described by one of us (Welch) in 1889, in essential conformity with those described in the publications of the Bureau of Animal Industry. Two main types, with transitions, of virulence can be distinguished ; with one kind rabbits are killed by subcutaneous inoculation in from sixteen to thirty hours, usually with enormous multiplication of the bacilli in the blood and organs; with the other kind rabbits die in from two to six days, occasionally longer, with extensive seropurulent infiltration around the seat of inoculation, often with peritonitis, and frequently in these cases with few bacteria in the blood and organs, but an immense number in the inflammatory exudates. Similar variations in virulence occur with other bacteria of this group.

As our observations of the swine-plague bacillus have been either in hogs affected with hog cholera, or in hogs belonging to herds in which hog cholera was prevalent, it became important, as has already been mentioned, to make in every case complete bacteriological examinations, as without such examination one cannot be sure in case only one organism is found that the other has not been overlooked. Such complete examination includes not only the preparation of cover-slip specimens and of plate or roll cultures from all of

the organs, but also the inoculation of rabbits or mice with parts of the organs. We can refer to many cases where, if reliance had been placed exclusively upon cultures, or exclusively upon inoculation of animals, we should have failed to detect the presence of the second organism—either the hog-cholera bacillus or the swine-plague bacillus. If both the hog-cholera bacillus and the swine-plague bacillus are present in the part examined, and one of these bacteria greatly predominates in number over the other, cultures are likely to lead to the recognition of only the predominant bacillus, as the second organism may not appear in the culture, or, even if it does, its colonies are distinguished sometimes with such difficulty from those of the other that they can readily escape detection. If a rabbit or mouse be inoculated, the animal will die of swine plague, and the co-existence of hog cholera will thus be unrecognised, if the animal experiment be solely relied upon. In the latter case plate cultures, as has already been mentioned, from the seat of inoculation, may reveal the hog-cholera bacillus associated with the swine-plague bacillus. We have already referred to cases in which the swine-plague bacillus was present in the lungs, or in the lungs and all of the organs, including the intestine, and still the hog-cholera bacillus was found also in the intestine. The separation of virulent hog-cholera bacilli from the intestine in such cases, with general swine-plague infection, is difficult enough in many cases, but much more difficult is the isolation from the intestine of varieties of the hog-cholera bacillus attenuated in virulence. Indeed, so difficult is this that one can rarely feel sure that it may not have escaped recognition. As has already been mentioned, in prolonged cases of hog cholera the hog-cholera bacilli may have disappeared entirely, so far as the most thorough bacteriological examination can determine ; and in some of these cases we have found, with the characteristic intestinal lesions of hog cholera, pulmonary or even general infection with the swine-plague bacillus. The intestinal lesions, however, were so characteristic of hog cholera that we were not misled into supposing these cases to be primary swine-plague infections.

Of the epizootics studied by us there were more of hog cholera combined with swine plague than of hog cholera without this complication. It is this frequent association of swine-plague infection with hog cholera that has rendered especially difficult the bacteriological study of hog cholera, and the determination of the pathogenic *rôle* of each of these species of bacteria. It is this association which makes it of

first importance to determine by experimental inoculation of swine, and by the examination of uncomplicated cases of each variety of infection, exactly what the hog-cholera bacillus can do and what the swine-plague bacillus can do, alone or in combination with each other.

We have already stated our conclusions as to the pathogenic and etiological *rôle* of the hog-cholera bacillus. We have proven by experiments, which we believe were conducted with the strictest precautions to guard against error, that the hog-cholera bacillus can produce all of the lesions of the natural disease which we have enumerated, including characteristic extensive pulmonary hepatization and intestinal buttons, lesions which, as far as we can determine, had not before our experiments been satisfactorily reproduced by inoculation of pure cultures under strict precautions to avoid accidental and previous infection; and we consider that the experimental production of the typical button-like lesions was essential in order to establish positively the causative relation of the hog-cholera bacillus to the natural disease—hog cholera. As the workers in the Bureau of Animal Industry deny that the hog-cholera bacillus can produce pneumonia, save possibly some broncho-pneumonia, our demonstration that this bacillus may cause extensive hepatizations, such as are observed in the natural disease, and which they refer apparently always to the swine-plague bacillus, we believe to be also an important addition to our knowledge of the pathogenic effects of this interesting micro-organism.

The class of cases in which we have found most frequently the swine-plague bacillus have been those with pneumonia and fibrinous pleurisy, not very infrequently also fibrinous pericarditis and rarely fibrinous peritonitis. The pneumonia was often very extensive, involving a large part of one or both lungs. The character of the hepatization varied, and was often mixed—grey, reddish-grey, red, hæmorrhagic, white, necrotic. There was sometimes much interstitial œdema or even solid interstitial exudate in the lungs. Coagulative necrosis with nuclear fragmentation occurs. The swine-plague bacilli were often abundant, either alone, or mixed with hog-cholera bacilli, in the hepatized lung and the exudates on serous membranes. The number, distribution and exclusive presence of swine-plague bacilli in these parts in many cases of the natural disease would lead to the probable inference that they were the cause of these inflammatory lesions; nevertheless, of course, such an inference must be confirmed by experiments on swine before it can be

accepted as a positive fact. The swine-plague bacilli were sometimes confined to the lungs or to exudates on serous membranes ; sometimes they were found also in larger or smaller number in one or more of the following situations: the blood, spleen, kidneys, liver, lymphatic glands, and intestine ; in other words, the infection with these bacteria may be either local or general. We were not able, however, to refer to their presence any definite lesions in these latter situations, save possibly in the intestine, a point, which, for manifest reasons, we felt required experimental evidence to decide.

We do not consider it necessary to report here our experiments in inoculating rabbits and other laboratory animals.

Our results from inoculation of swine with pure cultures of the swine-plague bacillus are briefly as follows:

There are marked variations in virulence. Some varieties possessed slight or no virulence when tested on swine. Other varieties were markedly virulent. The duration of life in fatal cases varied from sixteen hours to eight or ten days rarely more. We have not been in possession of any cultures of this bacillus which were generally fatal to swine by subcutaneous inoculation. We have records, however, of a small number of cases in which fatal general infection exceptionally followed this mode of inoculation, there being extensive inflammatory œdema at the site of inoculation. Intravenous inoculation of very large doses of virulent cultures was generally fatal, of smaller doses was occasionally fatal, often not. By this method of inoculation, even with small doses, we have succeeded in producing multiple serositis (fibrinous pleurisy, pericarditis), both with and without pneumonia. Direct inoculation into serous cavities was sometimes not fatal, although it caused more or less extensive fibrinous inflammation; sometimes it was followed by rapidly fatal general infection with local or multiple serositis. Inoculation directly into the lungs, or better, into the trachea of bouillon cultures, furnished us with a number of examples of exquisite characteristic pneumonia, with necrosis, such as has been described, associated with fibrinous pleurisy, sometimes with pericarditis. Like other methods of inoculation, however this one was not uniformly fatal, even with virulent cultures. Feeding even enormous quantities of swine-plague cultnres, as well as the bodies of animals dead of swine plague, produced no effect; and pigs so fed and killed at varying intervals, presented no definite lesions of the stomach and intestine. Inoculation in two cases directly into the intestine after laparotomy was

followed by fatal peritonitis without characteristic lesion of the intestine, some of the culture having evidently entered the peritoneal cavity. Combined inoculations of swine plague and hog-cholera cultures, or inoculations of swine plague before or after inoculation of hog-cholera cultures did not give satisfactory evidence of increased susceptibility of the swine to one or the other of these organisms. Mixed infections were obtained in this way, resembling mixed natural infection.

In fatal cases of pure experimental swine-plague infection of swine we noted in several, but not in the majority of cases, swelling of the follicles, hyperæmia, diffuse redness, and ecchymoses in the intestinal mucosa, particularly of the large intestine, combined often with catarrhal enteritis. Superficial erosions of the hæmorrhagic foci and superficial necrosis of these foci were rarely observed. The swine-plague bacillus may produce a hæmorrhagic enteritis, as our experiments show. No extensive intestinal diphtheritis, necrosis, ulceration, and nothing resembling the button-like lesions of hog-cholera were observed.

In sequestrated sloughs and local imflammatory exudates produced by inoculation of swine.plague bacilli we have found living and virulent swine-plague bacilli as long as two months after the inoculation, the animals having otherwise recovered, and having been killed for examination. The swine-plague bacilli, therefore, may survive in the animal body longer than in cultures.

The bacteriological examination of pigs dead of experimental swine-plague infection showed the characteristic bacilli pure and in enormous number in the local inflammatory exudates, and in smaller number in other parts, or absent entirely from other parts.

We may conclude, therefore, from these experiments that virulent swine-plague bacilli are capable of causing general infection, and more especially local infections characterized by pneumonia and fibrinous inflammations of serous membranes. This conclusion is in harmony with the observations of the distribution of this micro-organism and the lesions observed in the natural disease. We find no evidence that the swine-plague bacillus can produce intestinal lesions which are characteristic of hog cholera, although they may cause ecchymoses, hyperæmia, hæmorrhagic enteritis, catarrhal inflammation, and probably superficial necroses and erosions. The experimental evidence that they may cause superficial croupous or diphtheritic inflammation of the intestinal

mucosa is not conclusive. Notable differences between the hog-cholera bacillus and the swine-plague bacillus are the certainty with which virulent cultures of the former cause intestinal diphtheritis by feeding, and the innocuousness of feeding cultures of the latter to swine, and also the readiness with which pneumonia and fibrinous serositis may be produced by inoculation of the swine-plague bacillus, and the comparative difficulty of producing these lesions with the hog-cholera bacillus.

Theobald Smith considers that natural swine-plague infection is to be regarded as an infectious pneumo-enteritis rather than an infectious pneumonia.* The intestinal lesions which he attributes to the action of the swine-plague germ are hyperæmia, hemorrhages, catarrhal inflammation and a peculiar croupous exudation occurring as "circumscribed masses of fibrin easily lifted away from the mucosa, leaving a paler, slightly depressed spot, showing no necrosis of tissue." The last lesion and others which he has described are considered to be different from any produced by the hog-cholera bacillus. So far as we can judge from this description, and particularly from the plate illustrating the lesion, we should not regard this lesion as different from that which may be caused by the hog-cholera bacillus, both experimentally and in the natural disease; and in general we do not consider that Dr. Smith has succeeded in proving or even rendering probable that the swine-plague bacillus produces intestinal lesions of a peculiar character distinguishable from lesions which may occur in hog cholera. In only one instance, published by Theobald Smith, was the experimental inoculation of swine with the swine-plague bacillus followed by an intestinal exudate. This case is described as follows: "In one case, as a result of the peritonitis following an intra-abdominal injection, the walls of the small intestine were swollen, inflamed, and a copious, friable, yellowish exudate had formed on the deeply-inflamed mucosa." This would appear to have been a superficial diphtheritis, and is attributed by Dr. Smith to an extension of the peritonitis.

That there may be superficial intestinal areas of necrosis with slight loss of substance on a hæmorrhagic basis after experimental inoculation of the swine-plague culture, we have observed and already noted. The well-known relation of epithelial necrosis of mucous membranes to croupous and diphtheritic exudations, and the variety of agencies which may in this way induce intestinal diphtheritis, would render

*Theobald Smith, op. cit., p. 149.

it probable that now and then such superficial diphtheritis may be due to the swine-plague bacillus; but at present the evidence for this is, in our judgment, inconclusive. The fact that feeding swine-plague cultures is not followed by any damage to the intestine, is not conclusive evidence that other methods of penetration of the bacilli may not cause intestinal lesions. We have observed the intestinal lesions above specified not only after inoculation of rabbits, but also after intra-venous, intra-thoracic, and intra-tracheal inoculation of swine with swine-plague cultures, although in most of our experimental cases, the intestine was not affected.

The lesions, therefore, which we have succeeded in producing in pigs experimentally by inoculation of the swine-plague bacillus, are most frequently pneumonia and inflammations of serous membranes, rarely hæmorrhagic enteritis associated with these lesions, and still more rarely by subcutaneous inoculation spreading subcutaneous inflammatory œdema with general septicæmia. We are not able, however, to distinguish an intestinal form of swine plague, either as an experimental or natural disease disassociated from the pectoral form, nor have any cases of natural swine plague been observed in this country analogous to the so-called cutaneous Schweine-seuche, although, as already mentioned, we have exceptionally produced this form of the disease experimentally. Of course, it cannot be denied that in natural swine-plague lesions may occur which do not appear in the experimental disease, as well as lesions in the experimental not observed in the natural affection.

Usually from one and the same pig the swine-plague bacilli isolated in culture are possessed of essentially the same degree of virulence as tested upon animals; indeed, this is in general true of the swine-plague bacilli cultivated from pigs of the same herd affected with the disease. Nevertheless there are exceptions to this, as we have occasionally cultivated from the organs of the same pig, as well as from different pigs of the same herd, extremely virulent swine-plague bacilli, which uniformly kill rabbits by subcutaneous inoculation of small quantities in sixteen to twenty-four hours, and bacilli, which are fatal to rabbits, only after six or eight days. Of course, as already mentioned, it is not necessary to suppose that the degree of virulence possessed by the bacilli, either of swine plague or of hog cholera, isolated at autopsy, is necessarily the same degree which the bacilli primarily possessed at the time of invasion of the animal, as we have instances of modification of virulence of bacteria in the

animal body, particularly in long-standing disease. When, for example, we find hog-cholera bacilli greatly attenuated in virulence in pigs dead of chronic hog-cholera, it may well be that the bacilli at the onset of the disease were of the usual virulence, and that the attenuation has taken place in the body of the animal. The same is also applicable to swine-plague infection.

What anatomical differences are there in the natural disease between cases of pure hog cholera, that is, cases in which the hog-cholera bacilli are the only pathogenic organisms present, and cases of hog cholera associated with the presence of the swine-plague bacillus? In our experience, which on this point is in conformity with that of the Bureau of Animal Industry, the cases of combined hog-cholera and swine plague infections are characterized especially by extensive pneumonia and pleurisy, sometimes by fibrinous inflammation of other serous membranes, in association with the ordinary intestinal lesions of hog cholera. Fibrinous pleurisy and pericarditis may be present in these cases with little or no pneumonia, but in most cases pulmonary hepatisation is a marked feature of the combined infection. From the experimental evidence as to the pathogenic properties of the swine-plague bacillus already adduced, as well as from the bacteriological analysis of these cases, it cannot be doubted that the swine-plague bacillus is a cause of such pneumonias and fibrinous serositis.

In many of the cases of pure hog cholera without concurrent swine plague infection, pneumonia has been absent or there has been only such broncho-pneumonia as could be referred to bronchial strongyles which are extremely common in the pigs of Maryland. In a certain number of these cases of pure hog cholera, however, we have found pneumonia of a different type and resembling, in its tendency to become necrotic and its variegated aspect, the pneumonia caused by swine-plague bacilli. Usually the pneumonia was less extensive and less likely to be associated with extensive pleurisy than in cases of combined infection, but occasionally it involved large areas of one or both lungs, and there was fibrinous pleurisy. In these cases we found hog-cholera bacilli alone. It may be urged that in these cases the pneumonia was caused by swine-plague bacilli which had perished. In opposition to this view it may be stated that the swine-plague bacilli may survive at least two months in local exudates in swine as we have shown by experiment, and moreover some of these cases were recent cases, as was shown

both by the anatomical and the clinical characters. Again, we have demonstrated experimentally that the hog-cholera bacillus is capable of setting up such pneumonias in swine as those under consideration. For these reasons, therefore, we must differ from the views expressed in the publications of the Bureau of Animal Industry, and admit that the hog-cholera bacilli may cause and do cause pneumonia in swine. We do not wish to be understood as denying that the swine-plague bacilli may die after setting up pneumonia.

In this connection we must again call attention to the cases already mentioned in which we found swine-plague bacilli in hepatised lungs or in the lungs and other internal organs, or in one or more of these situations and in the intestine, and were able to detect hog-cholera bacilli, either virulent or attenuated, only or chiefly in the intestine. We are not aware that cases of this kind have hitherto been described. These were cases of hog cholera with intestinal lesions, most frequently in the form of typical buttons, combined with swine plague infection. The probable interpretation of these cases is that at an earlier stage of the disease hog-cholera bacilli were present as usual in internal organs, and that in the course of time they disappeared from these organs but remained in the intestine, which is the part generally most intensely affected by this micro-organism. That the hog-cholera bacilli may be found in internal organs, even when not demonstrable in the intestines, has also been mentioned.

It is not a wide step from these cases to those in which the hog-cholera bacilli have disappeared entirely from the body, leaving behind characteristic necrotic lesions. In these latter cases also the swine-plague bacilli may be present in the lungs and other organs, including the intestines, or they may be confined to the lungs. We have notes of several cases in which rabbits inoculated with typical necrotic buttons died of swine plague without hog-cholera bacilli demonstrable in any part of the body, including the intestine; but for reasons already mentioned we have no doubt that these buttons were caused by hog-cholera bacilli, and certainly not by swine-plague bacilli. We have also observed several cases with swine-plague bacilli in the lungs, and the rabbits were unaffected by inoculation of the necrotic buttons from the same case, showing that neither virulent swine-plague bacilli nor hog-cholera bacilli were present in these buttons at the time of death. All of these were cases of long standing. It is in these chronic cases especially that we have found hog-cholera bacilli of weakened virulence.

We have evidence, therefore, that hogs which have hog cholera may die infected with swine plague, such infection being characterised generally by pneumonia and pleurisy, when hog-cholera bacilli are demonstrable only in the intestine which presented the lesions of hog cholera; also, that hogs which have had hog cholera may die similarly infected without hog-cholera bacilli being demonstrable at the time of death in the intestine or other organs, although their previous presence is signalised by the persistence of intestinal lesions characteristic of hog cholera. We have also observed combined infection with swine plague and hog cholera in which the hog-cholera bacilli were so attenuated in virulence as not to kill susceptible animals by subcutaneous inoculation. Such attenuated bacilli may be in the intestine, and if confined to this situation the difficulty of demonstrating their presence may be so great that they will readily escape recognition.

These facts, which we are the first to demonstrate by bacteriological examination, must be borne in mind in interpreting cases with intestinal lesions in which only swine-plague bacilli can be detected at autopsy. Laborious as is the examination of the intestine for hog-cholera bacilli, in consequence of the mixture of bacteria there present, such examination, nevertheless, must not be neglected in suspicious cases in which the examination of other parts of the body fails to reveal the presence of these bacilli, and, as our experience has shown, a painstaking bacteriological examination of intestinal lesions will often be rewarded.

We feel compelled to say that not a few of the cases reported in the publications of the Bureau of Animal Innustry as cases of pure swine-plague infection, but with intestinal lesions sometimes, to say the least, highly-suggestive of hog cholera, were not studied bacteriologically in a manner to make sure of the absence of hog cholera bacilli from the intestine and not always of their absence even from other parts, and are not interpreted in these publications with sufficient reference to the possibilities of localisation of hog-cholera bacilli exclusively in the intestine, or of entire disappearance of demonstrable hog-cholera bacilli from the body, although we would not be understood as saying that these possibilities are wholly disregarded.

This criticism applies only to a certain number of their cases. We have no doubt that some of their cases are examples of swine plague uncomplicated by the co-existence or previous presence of hog cholera in the same animal.

We have no doubt of the occurrence of pure and uncomplicated swine-plague as an independent disease, and we have observed several such cases. These cases, in our experience, were scattered cases in hogs belonging to herds other members of which were affected with hog cholera. The evidence that the cases were pure swine plague lay in the entire absence in some of them of intestinal lesions, in the negative result of the examination of all parts of the body, including the intestine, for hog-cholera bacilli; in the anatomical and clinical evidences that the animals had not previously been affected with hog cholera or other disease; in the presence of the characteristic lesions of swine-plague, particularly pneumonia and fibrinous pleurisy, and in the demonstration in pure culture, and in large number, of the swine-plague bacilli in the lesions, and often also in other parts. To assume, under these circumstances, that these pigs were infected or had been affected with hog cholera as well as with swine plague is wholly gratuitous and unsupported by a particle of evidence.

It has not been our fortune to observe an epizootic of pure swine plague. All of our cases, and they have been numerous, have been either combined with hog cholera in the same animal or isolated cases of pure swine plague in herds of swine, some members of which were affected with hog cholera.

A critical study of the reports of the Bureau of Animal Industry on this point shows that their experience has not been widely different from our own, although their interpretation of some of their cases differs from that of similar ones observed by us.

In the various epizootics of swine plague, arranged in eleven groups, studied by Theobald Smith* there are unquestionably cases of pure swine-plague infection, but not one of these epizootics can be regarded as free from hog cholera in some of the pigs of the same lot. Thus in the groups numbered II., IV., V., VII., VIII., IX., X., and XI. the hog-cholera bacillus was demonstrated in one or more of the pigs, that from IX. being attenuated in virulence. In Group I. "ulcers or indurations of the mucous membrane" of the intestine are stated to be rare, but that they occurred at all makes it probable that some of the pigs had hog-cholera. Cultures were made only from the spleen. In only one of the eight cases examined did anything grow, and in this both the colon bacillus and the swine-plague bacillus were found. Group III. need not be considered, as only parts of lungs sent

* Op. cit.

to the Bureau were examined bacteriologically. In Group VI. the intestinal lesions are stated not to have "differed on the whole from those observed in hog cholera." Cultures were made only from the spleen. The hog-cholera bacillus was not found, unless possibly in a non-virulent form. In three of the ten cases examined the swine-plague bacillus was demonstrated in the lungs by inoculation of rabbits. The statement as to the intestinal lesions and the incompleteness of the bacteriological examination make it impossible to regard this as an epizootic of pure swine plague.

We know of no reason why epizootics of swine plague without admixture with hog cholera in at least some of the pigs of the same herd should not occur, but that such epizootics actually do occur in this country remains yet to be demonstrated.

How are we to explain the frequent associations of swine-plague infection with hog cholera? The observation made by Theobald Smith, that bacteria closely resembling and probably identical with swine-plague bacteria are frequent inhabitants of the exposed mucous surfaces of healthy swine and other domestic animals, is highly suggestive, and favours the view that the swine-plague bacillus is a secondary invader in many cases of hog cholera, just as in typhoid fever and other primary infections in man we have often enough the secondary invasion of pathogenic bacteria often present on healthy mucous membranes. Such an explanation seems satisfactory for the cases in which hog cholera and swine plague are associated in the same animal, but swine plague may occur in pigs which have no hog cholera. As in the cases of the latter kind thus far observed other pigs in the same herd have hog cholera, one may perhaps suppose either that this hog cholera in other pigs has in some way increased the susceptibility of the exposed pigs, which have not actually contracted the disease, to the swine-plague bacillus, or, more probably, has increased the virulence of the swine-plague bacillus so that it can attack healthy pigs. Assuming some such explanation, simply as an hypothesis without demonstration, it would not be probable that hog cholera is the only agency which could increase this susceptibility or enhance this virulence, but other agencies have not been brought to light in this country.

It remains to consider whether the swine-plague bacillus can be identified with any of the bacteria observed in swine diseases in Europe.

(*To be continued.*)

Editorial.

PROTRACTED VETERINARY EDUCATION.

AMONG the changes for better and for worse (chiefly the latter), which have been inaugurated by the Council of the Royal College of Veterinary Surgeons during the last few years, that relating to the extension of the period of veterinary study will probably prove to be the most momentous in its results of any that have taken place in our time, or even since the profession became an incorporated body, if it be carried out for a few years. The alteration of the bye-laws regulating the period of study, and which was passed on July 21st, 1892, extended the term from three years to a minimum of four years, during which the student has to pass four examinations. This new regulation is to come into operation on April 7th next, and the modifications in the course of instruction given at the schools consequently commenced, it is presumed, with the opening of these in the beginning of last month. The effect of this step was predicted by many of those who are best acquainted with the position and requirements of veterinary medicine in this country, and who could see no reason for this extension, as there is no evidence that three years' study is insufficient if the time be properly employed; but the first demonstration of the evils of this ill-judged and injudicious move has made itself apparent sooner than was anticipated. It was thought that some time might elapse before the public discovered that paying ten shillings for an article that was only worth half-a-crown is not an advantageous or very wise transaction. But they have shown that they perceived the folly of such a procedure at once, and evidently decline to be led into a bad bargain. From information we have obtained from a trustworthy source, the entries of new students to the schools in October—the usual time for the largest number to seek admission—has fallen almost to zero; at one school there were only fifteen, at another fourteen, at a third nine, and at the fourth none at all! There may have been a few more entries since the date of our information, though this is scarcely probable; and there can be no other conclusion arrived at, we think, than that the public do not consider the diploma of the Royal College worth the time, trouble, and money now demanded for its acquirement. There are very many members of the profession, if we mistake not, who will

concur in this opinion ; but in the meantime the falling off in the number of entrants simply means ruin to the veterinary schools, which exist mainly, if not wholly, on the students' fees, and have to incur the same expense in keeping up a teaching staff and providing for the many other items indispensable in tuition, no matter how small the classes may be. Therefore the schools are the first to suffer from a diminution in the number of students, though they will not be alone in feeling the effects of the decrease. The Royal College itself depends for its maintenance on the examination fees, and though, through the wisdom and excellent management of the Council previous to the advent of the members who have brought about this crisis, a considerable reserve fund had been accumulated, this will disappear more rapidly, perhaps, than it was formed ; what will then happen it does not require much acumen to prognosticate. It is true that power was sought in the last Charter, so clamorously pressed for by a few wire-pullers, to increase the examination fees, but so far as that matter is concerned, the Charter is, we fancy, of as little value as the paper on which it is printed ; for no sanction or authority is given to impose any such increase, as though this is mentioned in the preamble it is not alluded to in the body of the Charter. Therefore students may decline to pay more than they have done hitherto, and we are assured that the law cannot compel them to do otherwise. One thing is certain, and that is, that such an imperfect Charter would not have been accepted by the Council previous to 1890. However, as there will probably be very few students to examine in a short time, this is only a trifling matter of detail.

Not only has the action of the Council now brought the schools face to face with ruin, and involved the Royal College itself in that disaster unless more wisdom is displayed than has been exhibited for the last four or five years, but grave injury has been done to the profession itself by the meddling and muddling of the Council with the Fellowship degree. The blundering Charter deprived it of half its vitality, and the wiseacre who drew up the new regulations for its obtainment robbed it of the other half. There has not been an examination this year, nor is there likely to be again ; for it may be asserted that there is no inducement now for members to work and pay for the degree.

And it may well be asked, what inducements are there for men of education to enter the Veterinary Schools under the new regulations ? Few indeed, must be the reply. During its best days ours was the most inferior of all the professions,

and its most able and persevering members could only rise to a comparatively low level; in this respect it differs from the church, the bar and the profession of arms. And it can never attain the position of human medicine, though some individuals, imitating the toad of the fable, imagine it is on the same plane. The reasons for this need not be alluded to, but it may afford one explanation to mention that the medical man enters the patient's bedroom and receives the confidence and countenance of the family, while the Veterinary Surgeon enters the stable, cow-house or piggery, and has to rely for much of his success upon the attendants of the animals which these abodes contain. And look at the difference in fees! There is much prating about the new educational arrangements making the Veterinary a learned profession. This is simply nonsense. It is not the length of time a student hangs about a school that makes him a learned man. The medical was a learned profession when the period of study was only two or three years, and so was the legal profession. If the veterinary student studied for ten years he would be in no better position, so far, at least, as emoluments and social surroundings are concerned, than the Veterinary Surgeon of the present day, and who, with all his increased knowledge and expenditure to obtain it, is not so well off as his predecessors of thirty or forty years ago. Many, perhaps the great majority, of Veterinary Surgeons have to keep shoeing forges to enable them to make a living, and this brings them into active competition with blacksmiths and horse-shoers; hence the designation of "farrier" so universally applied to Veterinary Surgeons by the public, who may often be excused for the mistake. To introduce regulations which are prohibitive of admission to the veterinary profession is not to make it learned, and there are certainly no new inducements offered which would compensate for the exactions these regulations impose. On the contrary, as we have frequently pointed out, the position of the Veterinary Surgeon in this country is daily deteriorating, and increased study and its attendant heavy expense will not retard this process. To get rid of contagious diseases, the crashing poleaxe and the stabbing knife of the butcher is much more the remedy now than it was centuries or even fifty years ago; and to see the remedy carried out Veterinary Surgeons are not employed by the Government (which ought to encourage Veterinary Science), but by briefless barristers, superannuated naval and military officers. and untutored laymen of various kinds and denominations, who are put over them or act instead of them.

With improvements in hygiene and animal management, and more knowledge of disease and its treatment by owners of the domestic creatures, these are very much healthier now than they were even a quarter of a century ago; so that the services of veterinary surgeons are steadily becoming less in request, and it may happen in the course of time that the shoeing forge will be more a necessity than ever it was, and reversion to the original condition become an accomplished fact. However this may be, certain it is that competition is daily becoming more severe and demoralising, and this renders the veterinary profession very much less attractive than in former days; so that in the same time and at no more cost, a young man can be prepared for entrance into a calling which holds out prospects of advancement towards an infinitely higher social and monetary position than he could attain, even under the most favourable circumstances, in the veterinary profession.

All this appears to have been overlooked or ignored by the Council, and by this new regulation, and in other ways, it shows its incapacity for managing the business of the profession in a safe and satisfactory manner. Meddling and muddling, tinkering and tampering, and needless or senseless talking have been the order of the day for the past three or four years, and we are now beginning to realise the effects.

There has been a rabid desire for changing everything that had been already wisely planned and established, on the pretence of improvement and progress, and this, too, by men whose judgment and ability have not been favourably displayed in the management of their own affairs.

Iconoclastic notions are rather in the ascendant among the *Hoi Polloi* just now, and it was an unfortunate day for the profession when they began to be aired in the Council chamber. It is so much easier to throw down than to build up.

It is earnestly to be hoped that wiser counsel will soon prevail in Red Lion Square, and that the steps so imprudently adopted may be retraced without delay. The existence of the Royal College is not guaranteed by its many Charters and its Act of Parliament, but depends on the wisdom and tact of its Council, and when these are not displayed it is in much peril from more than one quarter. It has had more than one escape from demolition, and the same dangers still exist. There are those who now pretend to be its friends, but who, not many years ago, were its most implacable enemies, and

they might be so again if it suited their purpose. Skating on thin ice is always a hazardous operation, and this the Council has been doing lately; it had better get on to solid ground.

SOME BIOLOGICAL PROPERTIES OF THE GLANDERS BACILLUS.

Bonome (*Rif. Med.*, July 23rd, 1894,) has investigated the distribution of this bacillus and its powers of resistance. He has come to the following conclusions:—(1) It is diffused not only by means of the exudations from the organs or tissues of affected animals, but also in the urine and milk. (2) The bacilli may pass from a mother to a fœtus through a perfectly normal placenta as well as through one presenting patches of hæmorrhages. (3) It is distinctly sensitive to the action of drying. If this takes place at a temperature between 25° and 30° in the absence of other organic substances all virulence is lost, and it ceases to develop if the drying process has gone longer than ten days. (4) If the drying is imperfect, as in an old cultivation on agar, the virulence is retained for several weeks. In distilled sterile water the bacillus dies out in five or six days. (5) It offers a relatively great resistance to heat. (6) Cadaverin in the proportion of 1 in 40,000 to 1 in 60,000 causes the bacilli to grow in the form of long filaments, and destroys all pathogenic powers. These phenomena are not transmitted to subcultures on normal media. (7) In the serum from a horse which has been affected with glanders, the bacillus does not vegetate, assuming a kind of resting form. (8) In normal ox serum, the bacillus presents almost the same phenomena, and this serum, filtered after a prolonged contact with the bacilli, possesses curative powers against the disease in certain animals. (9) Dog's serum, collected during treatment with mallein, is not suitable for the growth of the glanders bacillus. This may explain the protective powers of mallein against the disease in this animal.—*British Medical Journal.*

GLANDERS IN MAN IN RUSSIA.

In certain parts of Russia the transmission of glanders to mankind appears to be very frequent. Dr. Pedkow, for instance, reports that in the district or circle of Berdian, sixteen cases were observed in 1891, and twenty-nine in 1892-93. The increase in the number of cases in 1892, seems to have been due to the fact that the medical men had learned to diagnose the disease, as before that time it must have been often mistaken for diseases more or less resembling it, so far as symptoms are concerned. The persons involved belonged to the agricultural class, which believes that glanders is a benignant malady. In order to cure rheumatism in the hip and limb, a Tartar rubbed the parts with portions of the brain of a glandered horse, and in this way became affected with the disease.

THE RESPONSIBILITY OF OWNERS OF GLANDERED HORSES.

An important case came before the the Court of Justice at Rouen, France, recently, which deserves attention. A farmer, M. Neuville, had two horses affected with glanders, and in the stable they inhabited several of the farm labourers slept, according to the custom of the country. One of these men became infected with the disease and died in a few days. The farmer was proceeded against and found guilty, not only of concealing the disease among

his horses, but also of homicide. Attenuating circumstances were allowed in awarding punishment, and for the first offence he was fined fifty francs, and for the second two hundred francs.

AVIAN DIPHTHERIA AND ANGINA IN MAN.

LOIR AND DUCLAUX (*Ann. de l'Inst. Pasteur*, August 25th, 1894), state that the rearing of fowls has been almost abandoned in Tunis, owing to the enormous mortality caused by a disease characterised by the formation of false membranes in the throat. Experiments made in the Bacteriological Institute of Tunis showed that the disease was due to a small bacillus present not only in the false membrane, but in all the organs and tissues, and quite different from the true bacillus of human diphtheria (Klebs-Loeffler). The bacillus has rounded extremities, and is mobile; on gelatine it gives a creamy-white streak, on agar-agar a greyish-white streak (at 39° C.); on potatoes, at ordinary temperatures, an abundant yellowish-white growth. In bouillon at 35° to 40° C. it grows rapidly, and renders the liquid turbid, yielding finally a viscous, whitish deposit. In stab cultures it gives a small whitish growth. It is both aërobic and anaërobic. It is easily stained by ordinary methods, but not by Gram's. It is killed by a temperature of 60° C. Heated to 55° C. for half-an-hour, its virulence is attenuated, and it can be used for vaccinating fowls. Among persons attending to fowls in Tunis a large number of cases presenting symptoms of diphtheria occur. Loir and Duclaux have made a bacteriological examination of six such cases, and in one, a child suffering from severe angina, with false membranes, which were neither very thick nor very adherent, they found the bacillus which they had observed in fowls. The child resided at a farm at which the fowls had been suffering from diphtheria for six months.—*British Medical Journal.*

SAD ACCIDENT TO A VETERINARY SURGEON.

A SAD accident befel Professor Dewar of the Dick Veterinary College, Edinburgh, on the evening of October 13th, at Leith Docks. A cargo of sheep had been landed from a steamer from Iceland, and Mr. Dewar drove in a cab from Edinburgh to examine them, accompanied by his only son William, aged 11, and a friend. After examining the sheep, the party re-entered the cab to return to Edinburgh. The night was dark, and the driver, not being accustomed to the docks, mistook the road, and plunged into one of them. The occupants of the cab managed to break out, and the cries for help and the splash in the water arrested the attention of the crew of the Government training ship, "Dido," who threw lifebuoys, and lowered a boat. Mr. Dewar was unable to swim, but secured a buoy. He heard the cries of his son for help, but could render him no assistance; and before he himself was rescued, he had sunk from exhaustion once, but on coming again to the surface, he was saved by the boat. His friend could swim a little, and with the assistance of a lifebuoy, kept himself afloat until rescued. The cabman when landed was dead. Mr. Dewar's son was also drowned. The cabman was aged 60, and, it is said, was perfectly sober at the time of the accident. The cab and drowned horse were recovered, as was the body of the boy two days afterwards

THE VETERINARY PROFESSION IN UPPER CANADA.

A MOVEMENT is on foot in Upper Canada to improve the position of veterinary surgeons there, and it is proposed to do this by asking the Government to assume control of the Ontario Veterinary College; to appoint a board of examiners for this college, to consist of qualified veterinary surgeons

resident and practising in Canada; and to raise the standard of education in the college, so as to exclude illiterate persons from the ranks of the profession.

Reviews.

HYGIENE DES ANIMAUX DOMESTIQUES. HYGIENE OF THE DOMESTICATED ANIMALS. By H. BOUCHER. (Paris: J.-B. Baillière et Fils. 1894.)

The fourth volume of Professor Cadeac's *Encyclopédie Vétérinaire* is devoted to veterinany hygiene, M. Boucher, a teacher of this subject at the Lyons Veterinary School, having been entrusted with its productiou, and judging from the results the choice has been an excellent one. The volume is, we think, in every way equal to its predecessors, and that is saying a great deal in its favour. In a clear and concise form, we are given precise notions of the most recent acquisitions of science in the matter of animal hygiene, which embraces a study of the means and measures necessary to ensure the maintenance in health of the creatures man has domesticated, and their preservation from diseases which would damage their value.

In the first part of the volume, M. Boucher deals with the soil, water, air, and climates. In treating of the soil, he passes in review its physical and chemical properties, its mineralogical constituents and its coverings; then its purification and modifications by culture, its drainage, exhaustion, and irrigation. With regard to water, the conditions of its potability are examined, and its purification, its preservation, and its physical, chemical, and bacteriological examination described.

The atmosphere is also considered in its composition, its physical properties, and its alterations. The different climates are passed in review, and the French regional climates are of course more particularly considered. The question of acclimatisation forms a fitting termination to this part.

The second part is occupied with habitations, harness and equipment, grooming and feeding. After a chapter on general considerations with regard to the construction of habitations, the author treats of stables, cow-houses, dwellings for sheep, goats and pigs, kennels for dogs, and poultry yards. This is followed by sections on litter and manure, and the cleansing and disinfection of dwellings. In the section on harness are included clothing, means of restraint, and the equipment worn for work. Grooming embraces brushing, clipping, baths, rubbing, inunctions, and massage.

The subject of alimentation, which is one of so much importance, occupies no fewer than 200 pages. The different kinds of food of vegetable and animal origin are noticed, with their composition and digestibility. Then the writer passes on to the preparation of foods, and their alterations and adulterations, and, lastly, to their preservation. The volume terminates with a dissertation on the general principles of rationing and substitution of one kind of food for another, and a study of *régime*.

From this brief analysis it will be seen that the volume covers a wide space, in fact, everything included in the designation given to the book is handled in a masterly manner. We know of no treatise on the subject to equal it for scientific and practical treatment, and like the volumes which have preceded it, it reflects great credit not only on its author, but on the Lyons School. It should be added that a very pleasing introduction is written for it by M. Cornevin, Professor of Hygiene and Zootechny in that school, and that the descriptive sections are embellished with seventy illustrations.

DEMONSTRATIONS IN THE MODES OF HANDLING AND EXAMINING THE HORSE. By N. D. DHAKMARVALA, G.B.V.C. (Bombay: Ripon Printing Press. 1894.)

The author of this little manual of about 150 pages is the lecturer on

anatomy and physiology, and acting professor, at the Bombay Veterinary College. In the preface, he states that it was the intention of the late J. H. Steel, first Principal of the college, to publish a work on the subject, but his untimely death, in 1891, prevented this resolution from being carried into effect. Professor Dhakmarvala undertook the task from a feeling that there was need for such a book, especially to meet the requirements of veterinary students, and having produced it, he craves for a favourable reception for it, as it is his first attempt in professional literature. We have no doubt that his labour will not be thrown away, and that those for whom he has catered will welcome his booklet, as it will aid them materially in the examination of the horse in health and disease. It is always a source of gratification to find our Indian colleagues striving to inculcate in their compatriots proper notions on practical subjects connected with horse management and veterinary medicine and surgery, and especially when they can do so in such apposite English as the author does. In composing his book he has sought for assistance in a number of works, to which he alludes, as well as to notes of Professor Steel's lectures, and he also acknowledges the help he received from Veterinary-Captain Mills, now Principal of the Bombay School. While the whole of it is valuable to students in India, some portions are interesting to horsemen generally, such as the description of "castes" or breeds of horses found in that extensive portion of our empire. It certainly merits favourable recognition, and it is to be hoped that it will receive it.

LES OISEAUX DE BASSE-COUR. (POULTRY.) BY REMY SAINT-LOUP. (Paris: J.-B. Baillière et Fils. 1894.)

Though birds do not come so frequently within the purview of the veterinary surgeon as many of the other domesticated animals, yet a general and professional knowledge of them is not to be despised nor neglected. More especially does this remark apply to poultry, which form a considerable portion of the national wealth, and represent a large share of food production. M. Saint-Loup, who is conference master at the Ecole Pratique des Haute-Etudes, and secretary to the Société Nationale d'Acclimatation, has written a handy volume for the Bibliothèque des Connaissances Utiles, dealing with farmyard fowls in all their many varieties and breeds, as well as pigeons, and shows how they may best be bred, reared, and otherwise managed with success and profit. The book is divided into chapters, which treat of classification, variations of type in the principal breeds, selection, organisation, natural and artificial incubation, the avicole industry, diseases, parasites, cocks and pullets, pigeons, turkeys, peafowl, ducks, and geese. The author shows that he is perfectly acquainted with his subject, and he has made the most of his knowledge in laying before aviculturalists a guide which cannot be surpassed for lucidity, and the amount of information it contains in less than 400 pages. Good woodcuts are also given, depicting the different breeds of birds and the apparatus and appliances required for their successful management.

THE HORSE, ITS EXTERNAL AND INTERNAL ORGANISATION. BY A. SCHWARZ, Staff Veterinary Surgeon in the First Royal Bavarian Regiment of Light Horse. Revised and Edited by GEORGE FLEMING, C.B., LL.D., F.R.C.V.S., late Principal Veterinary Surgeon of the British Army. (London: George Philip & Son, 1894.)

The Editor of this little work says in his preface, that in a country in which the horse is held in such high esteem, and greatly valued beyond the other domesticated animals, no apology should be necessary for venturing to introduce the book to the notice of all lovers and admirers of that most useful creature; and for the simple reason that its elementary anatomy, its external

and internal organisation, is presented by means of very exact and clever moveable atlases, in a form that has not hitherto been attempted in England. By means of these atlases and the accompanying description, horse amateurs will gain a knowledge of the structure of the horse which could not be obtained so readily or perfectly by any other means, and which must prove interesting and useful to them in many ways. These remarks give a sufficient idea of Herr Schwarz's excellent booklet, the plates in which are admirable for their justness of delineation and clearness. Plate V. is capitally arranged, the internal organs being placed as in the living animal, and so fitted as to be raised up to show those beneath, as in a *post mortem* examination. Though intended for amateurs, and especially to illustrate lectures given to officers and non-commissioned officers of mounted corps, the student of veterinary anatomy might find it useful to refresh his memory, and especially with regard to the position of the viscera. We believe this is the first time such an atlas has been devised to show the anatomy of the horse, though similar ones have been published both in France and Germany, for the use of amateurs and students of human anatomy. The price is only three shillings and sixpence.

Army Veterinary Department.

Gazette, September 25th.

THE undermentioned Veterinary-Captains to be Veterinary-Majors:—W. B. Spooner and S. D. Gillespie.

Gazette, October 2nd.

Veterinary-Major M. F. M. Case is placed on retired pay,

Gazette, October 16th.

W. E. Russell, Gent., to be Veterinary-Lieutenant, in succession to Veterinary-Major M. F. M. Case, retired.

Veterinary-Major J. Hammond has gone to Egypt to take up the duties of Senior Veterinary Officer in that country. Veterinary-Captains D. C. Pallin and F. Raymond have embarked for India.

Obituary.

THE following deaths have been reported:—M. B. Forbes, M.R.C.V.S., Reigate, Surrey, who graduated in 1857; and McLaren Kitching, M.R.C.V.S., Cupar, Fife, a graduate of 1832.

Proceedings of the Royal College of Veterinary Surgeons and Veterinary Medical Societies, etc.

ROYAL VETERINARY COLLEGE.

AT the opening of the session, on October 3rd, the introductory address was delivered by Professor M'FADYEAN, M.B., B.Sc., who said that the session they were met to inaugurate was an important one in the evolution of veterinary education in this country. Veterinary students had now to furnish evidence of having received a general education equivalent to that required for the study of law or medicine, and they had to undergo a professional training extending over

a period of four years. That could not fail to enhance the social scientific *status* of British veterinary surgeons, and it would justify them in claiming that they belonged to one of the learned professions. The lecturer went on to say that he had decided to devote his remarks mainly to the subject of contagious diseases and their suppression, a theme that was the more appropriate because they were presided over on that occasion by Professor Brown, who, as veterinary adviser to the Privy Council and the Board of Agriculture, had done excellent service to the State in waging war with the contagious diseases of our domesticated animals. Veterinary surgeons had great reason to be proud, and agriculturists to be thankful, for the success which had crowned the efforts of the Board of Agriculture to eradicate pleuro-pneumonia and foot-and-mouth disease from this country. The stamping-out system had been characterized as barbarous, cruel, and unscientific, and some people at the present time appeared to have hazy notions that in the future there would be a great development and extension of protective inoculation as a means of dealing with animal plagues. When asked to advise in this matter, veterinary surgeons were exposed to some temptation, for the stamping out of such a disease as pleuro-pneumonia meant a permanent loss of veterinary surgeons' fees. It was quite certain that a general development of protective inoculation for the purely contagious diseases of farm animals would be a great source of gain to veterinary surgeons, and it was equally certain that it would be a great source of loss to the stockowners. As an illustration they might take the case of pleuro-pneumonia. Since the year 1881, outbreaks of that disease in France had been treated by slaughter of the visibly diseased, and compulsory inoculation of the remainder of the herd. In this country the pleuro-pneumonia slaughter order was introduced in 1888, and that ordained that when an outbreak of pleuro-pneumonia occurred, every animal in the herd must be slaughtered. What had been the result? In France veterinary surgeons were still making a good thing of inoculation, while in Great Britain they had no longer any cases of pleuro-pneumonia to treat. Stock-owners ought to take note of the fact, and give them credit for having advised a course of action that took money out of their own pockets, but saved it to the public. The brilliant success of the stamping-out policy in the case of pleuro-pneumonia, had induced the Board of Agriculture to attack swine fever in the same way, but that was a task of greater difficulty. No doubt it would be successfully accomplished in the end, but meanwhile it was not likely that the Board could be induced to take in hand any of the other contagious diseases, and it was worth considering whether any of them could be successfully attacked by veterinary surgeons and stockowners without the organized direction of the central authority. The lecturer thought that, thanks to recent discoveries, this could be done in the case of two diseases that were at the present time the cause of immense loss. The first of these diseases was glanders. A few years since it appeared as if glanders could not be successfully dealt with by any other method than wholesale slaughter of infected studs and compensation from imperial funds. To eradicate the disease by any other means was practically impossible because of the difficulty of diagnosis. Abundant experience had shown that to compel the slaughter of the animals obviously glandered, might suffice to keep the disease in check, but it could not entirely eradicate it from large studs. But the discovery of mallein had put an entirely new complexion on the question. By the aid which that substance afforded to diagnosis, any horse-owner could now free his stud from glanders, and keep it free, without having to kill a single animal, save those actually glandered. There was still much that they did not understand in the mode of action of mallein, but they knew that, for simplicity, safety, and accuracy as a means of diagnosis, it left little to be desired. Armed with the substance, any veterinary surgeon could within 24

hours point out every horse that was the subject of glanders in any stable. This was information that had been before the reading members of the profession for nearly two years, but, except in a few isolated cases, full advantage had not yet been taken of the important discovery. He did not know whether this was due to the fact that horse-owners did not wish to have precise information regarding the number of their horses affected with glanders, or whether veterinary surgeons, when consulted regarding the disease, had neglected to impress upon their clients that they were unable by any other means than mallein to detect glanders in its early stages. The former supposition could hardly be the correct one, for it imputed to the owners of glandered studs an almost incredible degree of stupidity. No compulsion ought here to be necessary, but if those who had glanders in their stables did not speedily take steps to eradicate it the law would have to be amended. The law as at present administered was certainly defective, for almost every day it permitted the sale of horses that had been exposed to the contagion of glanders. That was a public scandal which might promptly be stopped by giving the purchaser of any horse found (by the mallein test) to be glandered within a few days after the sale the right to recover the price paid for the animal. Glanders was now mainly a disease of London horses, and the stamping-out of it was perhaps hardly a question of national importance. That, however, could not be said of the other disease to which he wished to refer on that occasion. Tuberculosis was now by far the most widespread and, as regards the loss which it occasioned, the most serious, of the diseases of farm stock. Probably not less than 20 per cent. of the adult cattle in Great Britain were tuberculous. Could it be stamped out? He believed that that question might be answered in the affirmative. As a first step in that direction it was necessary to diffuse among agriculturists correct notions regarding the causation of the disease. The discovery of Koch's bacillus had in one sense settled all disputes regarding the cause of tuberculosis, but there still prevailed, both among veterinary surgeons and farmers, a very serious misconception regarding one factor in the propagation of the disease—viz., the belief that it was often congenital. For some time past they had had before them information that made that view quite untenable. They knew that when tuberculous lesions were sought for at birth in the progeny of tuberculous cattle, they were not found in one calf in a thousand. They knew, further, that in cattle under two years of age the proportion of tuberculous individuals was less than one per cent., and that it steadily rose with age until among adult cows it was seldom less than 10 per cent., and not rarely 40 or 50 per cent. These facts were quite incompatible with the view that hereditary transmission of the bacillus played a *rôle* of any importance in the propagation of the disease. On the other hand, every known fact regarding the incidence of tuberculosis, as regards age, breed, and locality, was in complete harmony with the view that it was a contagious disease, which could, with great certainty, be spread by housing tuberculous and healthy cattle together, but which had only feebly contagious properties among cattle kept in the open air. A few years since, even to the most sanguine, the possibility of being able to grapple successfully with the disease appeared very remote, because of the admitted impossibility of recognising it in its early stages, for to the most careful clinical observation a tuberculous animal might appear perfectly healthy and yet be capable of infecting others. But it was now in the power of any stockowner to stamp tuberculosis out of his herd at an expense that would be trifling compared with the loss entailed by the present neglect of all precautions against the spread of the disease. In any herd the use of tuberculin would enable the veterinary surgeon to separate the diseased from the healthy; and this, combined with thorough disinfection, would with great certainty arrest the spread of the disease. As regards the diseased animals, the owner might

be left to decide whether he would have them promptly slaughtered or not; the material point with regard to the arrest of the disease was that the infected animals should not subsequently be allowed to mix with the healthy. But if tuberculin made it possible for anyone to free his stock from tuberculosis it also afforded the means of keeping it free. No animal ought now to be bought for breeding purposes that was not free from tuberculosis as indicated by the tuberculin test. It was to be hoped that some of the famous breeders of pedigree stock would set the example of selling their animals with a guarantee of this kind.

NEW VETERINARY COLLEGE, EDINBURGH.

THE annual ceremony in connection with the beginning of the session of the New Veterinary College, Edinburgh, took place on October 3rd, in the large lecture hall of the institution. Principal Williams presided, and sitting near him were several members of the Corporation, including Lord Provost Sir James A. Russell, LL.D., Bailies Gulland and Macdonald, and Councillors Colston, Hay, Cranston, Hunter, and Sloan. There were quite a number of ladies to the right and left of the Principal. The college staff present included Professors Owen Williams, Macadam, Hunter, Longden, M'Dougall, Bradly, and Davis. Among the general company were—Colonel Longden, Major Wilson, Veterinary-Captain Moore, Army Veterinary Department; Professor Hughes, Cardiff; Messrs. F. N. Menzies, late secretary of the Highland and Agricultural Society; Bell, V.S., Carlisle; Hunter, V.S., Kelso; Borthwick, V.S., Kirkliston; Robb, V.S., Glasgow; Aitken, V.S., Dalkeith; John Aitken, Edinburgh; Lawson, Falkirk; J. R. Fraser of Reid Brothers & Co., Frederick Street, Edinburgh; Blackburn, Preston; Black, Howgate, Mid-Lothian; Storie, East Linton; Spruell, Dundee; Rutherford, Edinburgh; M'Gregor, S.S.C.; Inch, V.S., Edinburgh; Peter Moir, V.S., Edinburgh; Conachie, V.S., Selkirk; Bannatyne, V.S., Haddington; M'Gregor, V.S., Crieff; Brownlee, V.S., Coatbridge; Clark, V.S., Cupar-Angus; Taylor, V.S., Leek; Gray, V.S., Duddingston; Wardlaw, Lasswade; W. Gordon Campbell, solicitor, Edinburgh; J. M'Kelvie, Haymarket, Edinburgh, and others.

Principal Williams had a most enthusiastic reception on rising to open the proceedings. In the course of his opening remarks, he thanked those present for the hearty cheer which they had given him and his colleagues at the opening of the twenty-third session of the New College. He was proud to think that he was surrounded not only by his friends—friends who had been true and faithful to him from the beginning—but also by new friends, because new friends were more important to them in the future than old friends. When he saw round him friends who had been fellow-students and examiners with him before he became a teacher, he felt highly honoured. To those who were new students he gave a most hearty welcome to the City of Edinburgh and to the New College. He referred to the fact that the preliminary examination for veterinary students was now very high—they had to pass examinations as severe as those of the medical profession. He did not mean to say that the veterinary surgeon should not be made to attain a high standard of excellence, but he maintained that the fees paid to them were not so high as to induce men to enter the profession.

Professor R. S. MACDOUGALL, M.A., B.Sc., then delivered the inaugural address, taking for his subject "The Ancestors of the Horse—A Study in Evolution." He said:—When I was asked to give the inaugural address here to-day, and was wondering what subject I could bring before you that might interest you, my thoughts seemed instinctively to turn to the horse as a subject of never-failing interest. There is no need to argue an interest in the horse before my present audience. Many of you are here to make it your life study,

and if in the multitude of counsellors there be wisdom, there is every opportunity for the enterprising veterinary student to become wise in the consultation of the 4,000 or so separate works published in many languages on subjects relating to the horse. And yet it was not without some disquietude that I thought of myself, almost a *novus homo* in the veterinary world, intimating an address on the horse in the presence of several of the high priests and many earnest disciples of veterinary science—*Dicite quis, medici, medicis mediabitur itsis!*

At this period of discouragement, quotations in several of the veterinary periodicals showed me that a keen interest was being taken throughout the profession in a certain great statesman's British Association address, in its bearings on the evolution theory; and therefore I took heart of grace, and decided to give an account of what the fossil records show to be the ancestors of the horse, at the same time emphasising the testimony of the record in favour of evolution.

Among the hypotheses put forward as an explanation of the past history of Nature, the hypothesis of evolution—the development hypothesis—opposes the view that each species had a separate origin created at some definite point of geologic time, and denies that "there has been the succession of creations and destructions marking the history of life on our planet from its commencement, which such a view would entail." Instead, the believer in evolution rather "looks on all existing species as derived from species of pre-existing geological periods as offspring or by direct descent," states that there has been no breach in the continuity, that animal forms have been modified one from another in the lapse of time, and, further, that the types of structure become simpler, and more similar to each other as we trace them from later to earlier periods, and that, if traced back, quite simple forms would be reached. I propose to illustrate this in the case of the horse, tracing step by step the modifications by which, from a more primitive form, through a long line of ancestors, we arrive at the highly modified horse type of the present day. And it may be some satisfaction to the student of veterinary science to know, that here, at least, we are on sure ground, and that as far as the horse is concerned we are little troubled with the popular bugbear of "missing links."

One of the great divisions of the class "Mammalia" is the ungulata or hoofed animals. We divide this group into the *even-toed* forms represented by pigs, the hippopotamus, camels, and the ruminants, and *odd-toed*. With the *even-toed* group we have nothing at present to do. The *odd-toed* group comprises the horse, with its near relations the ass, zebra, and quagga, and the allied forms of rhinoceros and tapir. A comparative study of such seeming dissimilar forms of horse, rhinoceros, and tapir, and the attempt to show that they are branches in different directions of a less modified type, in spite of its interest, is a little outside of my present task, and excluding the allies I desire to concentrate attention on the horse itself.

I would ask you, first of all, to notice this chart—slide shown on the screen—of a section of the earth's crust, and to keep in mind chiefly the proper order of the divisions of the tertiary period, as I will be making constant reference to them. It is in the early Eocene deposits that we find the first traces of animal remains that can with certainty be referred to the ungulata, And, similarly, for the better understanding of what will follow, I call your attention to a diagram as I now proceed to compare the skeleton of the arm and leg of man with that of the fore and hind limb of the horse. First as to the fore limb:—

MAN.—*Upper Arm*—One bone, the humerus. *Fore Arm*—Two separate bones, the radius and ulna. *Wrist Bones*—Five metacarpals, each with a finger composed of three phalanges, except the thumb, which has only two.

HORSE.—*Upper Arm*—Same in horse. *Fore Arm*—In middle segment of horse, a radius, but the ulna is reduced and attached altogether to the radius. *Wrist Bones*—This is the so-called knee of the horse. In the horse, the middle or third metacarpal forms the cannon bone, and on each side of it are two small splint bones corresponding to the second and fourth metacarpal of man.

HORSE.—Only one metacarpal, and therefore only one finger, with three phalanges—the large pastern, the small pastern, and the coffin bone.

Comparison of hind limb:—

MAN.—The first segment has one bone—the femur or thigh bone. The second segment has two distinct bones—the tibia and fibula. Tarsal bones.

HORSE.—Same in horse. The second segment has a tibia, and a short, slender fibula united to the tibia. Tarsal bones forming the so-called "hock."

Below these the hind limb is in man and horse a complete repetition of the fore limb.

Just one word about the *dentition* of the horse. The formula is—incisors $\frac{6}{6}$, canines (in male only) $\frac{1}{1}$, grinders $\frac{8}{8}$=40. Rarely there is an additional grinder in front, bringing the number up to 44. The grinders, generally speaking, resemble one another, there being little or no distinction in the horse between pre-molars and molars, whereas in less modified forms the tendency is for pre-molars and molars to vary.

Although we know that mammals existed in the secondary age, we are not in a position at present to trace the pedigree of the horse further back than to Eocene times. It is allowed by all authorities on mammals that the least modified forms had the radius and ulna and the tibia and fibula quite distinct. Such, too, had five distinct and complete digits, all nearly of the same size. The typical number of teeth was forty-four, and these were all comparatively simple. As Huxley, in his "American Addresses," says—"The general principles of the hypothesis of evolution lead to the conclusion that the horse must have been derived from some quadruped which possessed five complete digits on each foot, which had the bones of the fore arm and of the leg complete and separate, and which possessed forty-four teeth, among which the crowns of the incisors and grinders had a simple structure; while the latter gradually increased in size from before backwards, and had short crowns. And if the horse has been thus evolved and the remains of the different stages of its evolution have been preserved, they ought to present us with a series of forms in which the number of the digits becomes reduced; the bones of the fore arm and leg gradually take on the equine condition; and the form and arrangement of the teeth successively approximate to those which obtain in existing horses."

I will now try to show you how this hypothesis has been verified by the evidence of fossil remains.

Some years ago, in early Eocene deposits in Wyoming, United States, Professor Cope and Mr. Wortman, in the course of their investigations, came upon the skeletons of creatures to which they gave the name of Phenacedus. This is a very generalised form, and it is now considered possible that Phenacedus may stand in the position of direct ancestor of the horse tribe. Not one, but several skeletons were got, and in a state of wonderful preservation. Nine or so species are known, and on the screen I now show you Phenacedus primœvus. This form was somewhat larger than a sheep. The skull was long and narrow, the brain was primitive, the hemispheres being small. The teeth numbered 44, $i\ \frac{3}{3}$, $c\ \frac{1}{1}$, $pm\ \frac{4}{4}$, $m\ \frac{3}{3}$. In the fore limb we find a humerus, a radius and ulna both fully developed; in the hind limb, a femur, and tibia and fibula, both fully developed. There were five digits, each having the typical number of phalanges; the third being the largest. The toes also numbered five, and were complete. The terminal phalanges

had hoofs, probably, rather than claws. A long tail was present. It is interesting to note, too, the primitive arrangement of the bones of the wrist, these being in two rows, one immediately above the other, so that the bones of one row correspond to, and articulate with the respective bones of the other row.

Another species, P. vortmani, is thus described by Cope:—"We can imagine P. vortmani as an animal with the comparatively slender build of the bull-dog, with neck and head proportioned more as the racoon, and with the rump more elevated than the withers, as in the peccary. The feet resembled those of a tapir or rhinoceros, but had a pair of short toes on each side, which did not reach the ground. To this, add a tail much like a cat's in proportions, and the picture is complete. The diet of this animal was omnivorous, with a smaller proportion of animal food than the hogs, for instance, use. The food is more likely to have resembled that of the quadrumana. What means of defence this species had, is not easily surmised, as the canine teeth and hoofs are not large."

Before proceeding to review, in succession, the other members of the series, from Eocene times down to Pleistocene, and recent, I wish to point out that the development seems to have proceeded along two lines, one in America, and the other in Europe; and as the American record is the more complete owing to the very favourable physical conditions, I will deal chiefly with it. To have anything like a complete palæontological record, it is necessary that we should have an uninterrupted series of strata with animals in sufficient abundance to have supplied remains. These conditions have been fulfilled in the Western or Rocky Mountain region of the United States, where, in the old lake basins, by the perseverance of Marsh and other coadjutors, a most marvellous collection of fossil remains has been obtained. After Phenacedus, the earliest known form (still in Eocene times) is Eohippus (*eos*, dawn; *hippos*, a horse). Eohippus had four well-developed toes on the fore feet, with a rudiment of the metacarpal of the fifth, and three toes on the hind foot. The radius and ulna were distinct. The teeth numbered forty-four. A later Eocene form is Orohippus, which shows the next advance in modification. In the fore limb we find now only four toes, the rudiment mentioned in Eohippus having disappeared. On the hind limb we have three toes, the middle one, and one on each side of it. We will see that this description of hind foot is found in the later Miocene forms. There is a distinct radius and ulna, and a distinct tibia and fibula. The molar teeth are still short-crowned and simple. The nearest European form to Orohippus is Hyracotherium, in which we see that the second row of wrist bones do not stand quite below the respective bones of the first row, but are shifted a little to the inner side of the foot. The change gives greater stability to the carpal region. There is a like change in the tarsal region. Coming now to lower Miocene strata, we meet with a form called Mesohippus. Comparing this with Orohippus, one of the toes has become reduced, the one corresponding with the little finger. There is still a distinct radius and ulna, and tibia and fibula, though Hutchinson suggests that the fibula was probably incomplete. There are three toes behind. The next stage represented by Miohippus, found in the upper Miocene, is very instructive, as we find only three complete toes on the front limb, the one corresponding with the little finger showing as a mere rudiment, while the ulna is not so distinct as in the Eocene and lower Miocene examples. The nearest corresponding form to Miohippus in Europe is Anchitherium, remains of which have been obtained in France. Like Miohippus, it had only three toes (the second, third, and fourth) on the whole four extremities, the whole three reaching the ground, and with the middle one the largest. The ulna, though united with the radius, is complete, as also is the fibula. The teeth were forty-four in number, and, contrasted with

the teeth of our horse, the incisors have no marked pit. Canines well developed were found in both sexes. I pointed out in dealing with the dentition of the horse, that if seven grinders were present the first was very small—mere rudiments: as Flower says, "in the stage to which the horse has now arrived in its evolution, upon the point of disappearance." This first pre-molar well marked in Phenacedus and Hyracotherium, is also a good-sized tooth in Anchitherium. The crowns of the other grinders are short, and their shallow valleys are not filled with cement.

Coming now to early Pliocene times, greater changes are seen in Protohippus, and the allied European form Hipparion. Protohippus was about the size of an ass. It had three digits, the middle one the largest, but the other two still probably of use. The ulna is reduced. The grinding teeth are becoming more complex. Hipparion rather closely resembles the true horse, inasmuch as the digits on either side of the large middle one have become rudimentary, not reaching the ground, and thus of no service. Remains of such were found in Greece and in the corresponding deposits of South Germany and France. Bringing us close to the true horse we get in the upper Pliocene of America, a form called Pliohippus. In it the two side digits are greatly reduced, being mere splints, and thus resembling what we are familiar with in the horse. The true horse appears in the next period—the Pleistocene—where the second and fourth toes are mere concealed rudiments of the corresponding metacarpals and metatarsals, the third (or middle) toe being lengthened and having the terminal phalanx broadened. The radius and ulna have become fixed into one bone, as also the tibia and fibula.

Regarding the modifications of the limbs, Flower says:—"These modifications of the limbs thus gradually acquired in the course of time, must have been associated with gradually increased speed in running, especially over firm and unyielding ground. Short, stout legs, and broad feet, with numerous toes, spreading apart from each other when the weight of the creature is borne on them, are sufficiently well adapted for plodding deliberately over marshy and yielding surfaces, and the tapir and the rhinoceros, which in the structure of the limbs have altered but little from the primitive Eocene forms, still haunt the borders of streams and lakes and the shady depths of forests, as was proably the habit of their ancient representatives; while the horses are all inhabitants of the open plains, for life upon which their whole organisation is in the most eminent degree adapted. The length and mobility of the neck, position of the eye and ear, and great development of the organ of smell, give them ample means of becoming aware of the approach of enemies; while the length of their limbs, the angles the different segments form with each other, and especially the combination of firmness, stability, and lightness in the reduction of all the toes to a single one, upon which the whole weight of the body and all the muscular power are concentrated, give them speed and endurance surpassing that of almost any other animal."

There is a law familiar to the biologist termed the Law of Correlation of Growth. This is a sort of synthetic growth, the law referring to changes taking place in some organs or tissues because some other organ or tissue is changing under the agency of natural selection. This law is illustrated in the case of the evolution of the horse, inasmuch as accompanying the modifications of the limbs, there are modifications in the structure of the teeth, there being from the simpler teeth of the earlier forms gradual changes giving rise to forms of greater complexity, culminating in the complex teeth of the horse of the present day, with the incisors showing the well-known and well-marked pit with long-crowned grinding teeth. These long crowns are gradually pushed up as the surface wears away, a peculiarity associated probably with the removal of the animal from swamps to drier plains, and hence, from soft

moist vegetation to food more difficult of mastication. Accompanying all these changes there was a gradual increase in size from the earliest to the latest forms.

I daresay all of you have heard of, or perhaps have seen, specimens illustrating polydactyly in the horse. Professor Cossar Ewart has in his possession at the university several such specimens. Hutchinson, in his most interesting book, "Creatures of Other Days," has given a *resumé* of some such cases. He instances the horse of Julius Cæsar with its extra digits, and quotes an old historian thus—"Cæsar used to ride a remarkable horse which had feet that were almost human, the hoofs being cleft like toes. It was born in his own stables, and as the soothsayers declared that it showed his owner would be lord of the world, he reared it with great care, and was the first to mount it; it would allow no other rider." An extra toe may occasionally appear either on one fore foot or both, and so with the hind feet, too. The form I now show you on the screen was described by Marsh as the eight-toed Cuban horse, and is an example of an extra toe being developed on all four limbs. In very rare cases, both fore and hind feet may have two extra toes fairly well developed, and perhaps the most curious case of all is the horse preserved in the museum ot Yale College, which, besides having two extra toes on each foot, had concealed beneath the skin the remains of another one, corresponding to our thumb.

Such cases are not merely interesting freaks, but have a very important relation to the evolution of the horse, as cases of reversion to the old types. In conclusion, for those of you who have the inclination to inquire more fully into the subject I have just brought before you in a necessarily hurried and very general way, owing to limits of time, I would recommend a study of Flower's little book on the horse (in Modern Science series), Huxley's "American Addresses," Hutchinson, and, if possible, the researches of Marsh and Cope, to all of which I cordially acknowledge my own indebtedness.

Principal WILLIAMS, at the close of the address, spoke of the Canadian pleuro question, and showed several slides by lime-light illustrating pleuro-pneumonia, and what he termed the Canadian lung-disease or broncho-pneumonia. Perhaps, he said, he would do better to let sleeping dogs lie, but it was a difficult matter not to have the last word, although he confessed the majority of opinion was dead against him. There had been an investigation in this Canadian lung disease, and he did not find fault with the Board of Agriculture, for he had the opportunity of examining the last lung if he had not been otherwise engaged. He had a most important engagement in Argyllshire, which he could not put off. He said he could go to London on the Tuesday, but the thing had to be done there and then. But, after all, the evidence adduced at the investigation was to him most unsatisfactory. The very, very strong evidence, and from a man that could give the strongest possible evidence, if he could really contradict him, was that he (the witness) would not like to say that it was not pleuro-pneumonia; that if he found the same condition in the lungs of the cattle of this country, he would consider it as pleuro-pneumonia. That evidence amounted to nothing. After carefully reading the evidence in the Blue-book, he maintained his former opinion. He said he would give them the opportunity of seeing the difference in three slides of photographs from sections of lungs—one set showing what broncho-pneumonia, or Canadian lung disease, was like, and the other the pleuro-pneumonia of this country. The Principal pointed out that broncho-pneumonia was a disease which commenced in the bronchial tubes, and any discharge which might take place from the tubes was that which was expectorated; or, if it were retained, it had been washed off in the preparation of the sections. In the case of pleuro-pneumonia, however, the disease came from the blood. It was due to an organism which was not yet quite recog-

nised, and which was contained in the blood, causing the development of the disease at the outside of each lobule of the lung. There was another great characteristic, and there, in his opinion, the Government were entirely wrong in not having a microscopic examination of the lung. There was always a disposition in the Canadian disease to the development of new tissue. In the case of pleuro-pneumonia, the great characteristic was that there was an exudation of fibrine from the vessels into the tissue, but there was no tendency to the organisation of that fibrine. It remained fibrine so long as the animal was in life. Principal Williams said that he had brought this matter before them to show that, although the weight of evidence was against the opinion he had given, and that although the Government was acting upon that weight of evidence in excluding Canadian cattle from this country, at least he had some grounds for maintaining the position that he, perhaps, too strongly maintained from the beginning up till the present time.

General TWEEDIE, who was introduced by the Principal as a well-known authority on the Arab horse, and an author of no mean distinction, proposed a vote of thanks to Professor M'Dougall for his address. In doing so he referred to the fact that veterinary surgeons in the army were now, in the fullest sense, recognised to be officers and gentlemen—a thing that should have been the case long ago. While that was so, they had great responsibilities, and required to be highly learned in the arts and sciences.

Lord Provost Sir JAMES RUSSELL proposed a vote of thanks to the Principal for presiding, and both motions were most heartily endorsed by the audience.

The proceedings then terminated.

THE DICK VETERINARY COLLEGE.

ON October 3rd the seventy-second session of the Royal Dick Veterinary College, Edinburgh, was opened, when the introductory address was delivered by Mr. THOMAS A. DOLLAR, M.R.C.V.S., London, who graduated at the College fifty years ago.* Lord Provost Sir James A. Russell presided, and a large and representative audience included Bailies M'Donald and Gulland: Councillors Cranston, Gibson, Scott, Hunter, and Waterston; Mr. Skinner, Town Clerk: Professor Chiene, Professor Cossar Ewart, Professor Struthers, Mr. Finlay Dun, Mr. James Macdonald, Secretary of the Highland Agricultural Society; and Mr. F. N. Menzies, late Secretary of the Highland and Agricultural Society; and others.

The LORD PROVOST, in the course of his introductory remarks, expressed regret at the absence of Principal Walley through illness, and referred to the position which the College occupied in the veterinary world. It had, he said, taken a foremost place in the veterinary education of the country, and the success of the students of the College had of late years been very marked indeed. During last year, out of 135 names added to the register of qualified practitioners in Great Britain, 48 passed from the Dick College, being 4 more than from the English college, and more than from any other Scottish college. At the last professional examination, in the summer of this year, 85 students took their diplomas, and 33 of these were from the Dick College. That was a remarkable testimony to the excellence of the teaching of the College. There was a project just now for increasing the educational resources of Edinburgh in relation to scientific subjects, a proposal having been set on foot to found a system of comprehensive and co-ordinate teaching in rural economy all along the line. There was another proposal, which, if

* The Register of the Royal College of Veterinary Surgeons shows that Mr. Dollar received the Highland Society's certificate in 1851, that is only forty-three years ago.—ED. *V.J.*

carried out, would vastly improve the status of the veterinary profession, and that was that the university should give the degree of Bachelor of Science to the students who deserved it. That would be a large incentive to those entering the veterinary profession to become really scientific men, and would add, not only to their knowledge of the best methods of dealing with animals, but to a knowledge of medicine as a science as well as an art. His lordship concluded by introducing Mr. Dollar.

Mr. DOLLAR took for his subject—"William Dick, the Founder of the College." He said the name of William Dick must be placed at the head of those who had devoted their lives to the profession of the veterinary surgeon. Dick was distinguished for the breadth and enlightenment of his views, for his remarkable powers of observation, and for his untiring energy in the pursuit and teaching of his profession. He had rapid powers of diagnosis, and he could tell the lame leg of a horse and the seat of the lameness by hearing the animal trot in the street. A great practitioner and a great teacher, he seldom failed to rouse the sympathies of his pupils so as to impress upon them much of his own peculiar character. The worldly success of his students was often due to the continued and judicious advice he was ever ready to afford them. An intense lover of horses, his mind often revolted from the cruelties practised on them when being treated for disease; and having in vain urged the necessity of founding a system of surgery and practice, he resolved to devote his energies to the foundation of a college for the promotion and elevation of the profession. Mr. Dollar sketched the life of Professor Dick, showing how few were the advantages with which he commenced his career, and how his great position was built up by unflagging energy and devotion to his students and high professional integrity. When he set himself to raise, if not, indeed, to create, the veterinary profession in Scotland, the work of treating animals for disease was in the hands of farriers, cow-leeches, shepherds, and wise women. The ignorance of these charlatans was appalling. Dick superseded them by qualifying himslf to train a generation of practical veterinarians, and thus greatly to benefit the agriculture of this country. Looking around at that large audience gathered to do honour to William Dick, it seemed rather singular to recall that only seventy years ago he was an unknown man, struggling to advance his calling, and even glad when he had only one auditor. He next sketched the origin and progress of the Dick College, and enumerated some of the many eminent men who had been associated with it, and the distinguished teachers of the veterinary art who had sprung from it. Furthermore, the college had been instrumental in popularizing the veterinary art among country gentlemen, agriculturists, and young men destined for the colonies. The college presented a unique example among the veterinary colleges of the world, for while it had never received a single farthing from the State, it had steadily increased its scope and efficiency, and its history had been one of uninterrupted progress. Since Mr. Dick's death it had educated upwards of 1,500 students, and numbered among its graduates those holding the highest positions in the profession at home and abroad.

Mr. Dollar then presented to the college a portrait of Miss Mary Dick, sister of the late professor, painted by Mr. J. E. Christie, London; and Professor Baird, of the Dick College, presented, on his own behalf, a portrait of Professor Dick. Both portraits were unveiled amid loud applause, and the Lord Provost briefly accepted the gifts on behalf of the Dick Trust.

SOUTH DURHAM AND NORTH YORKSHIRE VETERINARY MEDICAL ASSOCIATION.

THE sixth Annual Meeting of the Association was held in the North Eastern Hotel, Darlington, on September 7th, A. Peele, Esq., President, in the chair.

There were also present Messrs. F. R. Stevens, C. G. Hill, W. N. Dobbing, C. T. Holmes, A. Neish, P. Snaith, H. H. Roberts, G. E. Gibson, J. E. Peele, W. A. Hancock, and W. Awde.

The following gentlemen were also present as visitors :—Professor McFadyean, London; Messrs. J. W. T. Moore, Newcastle; G. R. Dudgeon, Sunderland; H. Peele, Durham; W. H. Blackburn, Barnard Castle; Pratt, Leeds; D. Barningham, Darlington. Several apologies were received for non-attendance.

A letter was read from Professor Walley thanking the members for their vote of condolence with him on the death of his son. Letters were read from Messrs. W. T. Briggs and G. T. Pickering resigning their membership. The resignations were accepted with regret.

The Annual Financial Statement showed that the Association had a balance in hand of over £8 and that there were several outstanding subscriptions to come in.

Mr. SNAITH was elected Auditor in the place of Mr. Briggs resigned.

The PRESIDENT delivered the following address :—

Gentlemen,—I rise to thank you most heartily for having at the last meeting of this Association unanimously elected me your President for the ensuing year.

It was with very mixed feelings that I received our worthy Secretary's letter, after the meeting at Bishop Auckland, which I regret to say I found impossible to attend, telling me that I had been elected to this honourable position. I must confess I felt disposed to decline the honour on account of want of confidence in my ability to carry out the duties which hitherto have been so admirably carried out by my predecessors; but when I thought of the friends I had made in connection with this Association I decided to accept the post to which they had thought fit to elect me, and trust to their kind forbearance for my shortcomings, and to their assistance in carrying on the affairs of the Association, the welfare of which we all have so much at heart.

I have been rather at a loss for subjects on which I might touch in this short address, and I came to the conclusion that there was nothing new which I could put before you; so must ask you to forgive my want of originality, and to listen to what is old, though still of interest to us.

With regard to the registering of shoeing smiths, I believe we all looked with favour on a scheme the object of which was to improve the capabilities of the members of this important trade. But we did not bargain on their using the title "farrier," which was likely to mislead the public, for we north-country practitioners know very well that we are more often called farriers than veterinary surgeons, and we also know how keen most shoeing smiths are to do a little doctoring. We are heavily handicapped—with medicine boxes and chemists to wit—and can ill afford to allow the door to be opened to more quackery if we can prevent it.

Legislation which is so much needed on "tuberculosis" seems to be still far off. This is a serious matter, not only for individuals from a pecuniary point of view, but also for the public health. The butcher has to bear loss for the benefit of the public when he has the carcase of what was apparently a healthy beast when alive, condemned, owing to its being affected with tuberculosis, the local authority having no power to compensate him. Again, the local authority cannot prevent the sale of milk from tuberculous cows, although there is little doubt that this is a much more likely source of danger to the public than the consumption of tuberculous meat.

As to the inspection of meat, in towns where private slaughtering is permitted it is impossible to carry out an inspection worth mentioning. Only where there is a public slaughterhouse has the sanitary authority any chance of preventing the sale of diseased meat; hence, towns which possess a public

slaughterhouse gain notoriety for the seizure of tuberculous and otherwise diseased carcases; but as I have said before, legislation is required to allow of compensation to those who suffer loss for the benefit of the general community.

There has been some adverse criticism as to our position in carrying out the new swine-fever regulations, but I think those who have done work for the Board of Agriculture will agree with me that we are not so badly treated as some would lead us to believe. The regulations now in force ought to clear the country of the disease, but I am inclined to think that the old regulations were more simple, and, no doubt, would have been sufficient had they been carried out thoroughly by all.

There is a disorder to which pigs are very subject, and which is often reported as swine fever. The symptoms are as follows: A skin eruption consisting of numerous purple elevated patches, of various sizes and shapes, on the back and sides, loss of appetite, animal disinclined to move, little or no action of the bowels, temperature elevated sometimes as high as 107°F.; accelerated breathing and sometimes a cough. As a rule these cases recover with treatment, the great point being to get the bowels moved; but should a *post-mortem* examination be made we find inflammation of the stomach and bowels, the openings of the follicles around the ileo-cæcal valve very patent, and sebaceous material of a yellow tinge sticking about with fæcal matter. I believe the disorder is due to dietetic causes, for sometimes we find several pigs, subjected to the same conditions, affected.

As far as our social position goes I do not feel able to say much, although I agree with those who think that it depends greatly on us individually—how we live and with whom we associate.

The matriculation examination now in force should prevent the entrance into our colleges of illiterate men, and if they get through the four years' curriculum with the examinations of the Royal College of Veterinary Surgeons they should be scientific and practical veterinary surgeons.

It would ill become me to trespass on our time when I feel sure that we are all anxious to hear the paper on "Glanders" which Professor McFadyean has so kindly come here to read. My main object for addressing you was to thank you, which I do again, for placing me in the chair to preside over the meetings of this Association, and I can assure you that whatever I can do to further its interests will be done to the best of my ability.

Professor McFADYEAN then read a paper on "Glanders." He said that the disease had only one cause—the glanders bacillus, its spread being due to the inhalation by healthy animals of the germs derived from those diseased. His opinion was that the disease was nearly always contracted through the respiratory organs.

Having minutely described the tubercles found in the lungs in cases of the disease, the Professor remarked that they were hardly ever found in the bronchial glands. He then described the symptoms of glanders and also of farcy. He also stated that in many cases of the former disease, there were no nasal lesions. He advocated the slaughter of all visibly diseased animals when called in to deal with an outbreak of the disease, and the inoculation of the remainder with mallein, in order to find out if the disease was still latent in any of them.

Several of the gentlemen present related their experience of the disease, and asked various questions respecting the manufacture and use of mallein in the detection of the disease. One stated that if there was any doubt about a case, he believed a dose of physic would settle the point. Another asked if the Professor had ever noticed in glanders in mares, a case where the vaginal mucous membrane seemed to be affected with an intense discharge similar to that which came from the nostril, as he had seen such an one.

Professor McFADYEAN, in replying to the questions asked, stated very minutely how mallein was prepared, and gave instructions for its use. If an animal is the subject of the disease, and its temperature not over 101° F. before the injection, it will most likely rise to 104° F. or 105° F. within 14 or 16 hours, and a considerable swelling will form at the seat of the injection. He believed the indications afforded by the characters of the local swelling and the temperature, after injection with mallein, were nearly infallible. He should kill all that reacted, and repeat the test on the others a week afterwards, in order to make sure that there were no more cases. He also stated that mallein was safe to use, and that he would be glad to supply it gratis to any veterinary surgeon in private practice.

A hearty vote of thanks was accorded to Professor McFadyean for his kindness in having come so great a distance in order to read such an instructive and valuable paper.

This was carried unanimously, and the Professor suitably replied.

As the ex-President was not present, the usual vote of thanks to him was deferred until the next meeting.

Annual Dinner.

The annual dinner was afterwards held in the hotel. Mr. A. Peele presided, the vice-chair being filled by the Secretary. The loyal toasts having been duly honoured, the toast of the "Army, Navy, and Volunteers" was responded to by the PRESIDENT, he being an officer of the 4th Durham Volunteer Artillery.

Mr. SNAITH proposed the "Royal College of Veterinary Surgeons," coupled with the names of Professor Macfadyean and Mr. J. E. Peele.

Professor McFADYEAN, in replying, claimed that the Council were a hard-working body, and though they might differ in opinion, they were all striving to do their best for the interests of the College. He did not think that they could be called a non-progressive body. Some people might think they were rather too conservative, and others, again, that they had been too radical in their procedure during the past few years; but he submitted that the principal measures carried into effect by the Council were salutary measures, particularly the institution of the four years' curriculum and the new regulations as to the general education of students. Before many years passed over their heads they would all be ready, he thought, to admit that these were measures in the right direction. As to shoeing-smiths assuming the title of farriers, the Council of the College would consider the question, and, if it appeared to be necessary, the present arrangement in force would be rescinded by the College. The Council ought to have nothing to do with the licensing of shoeing-smiths if they were entering into competition with veterinary surgeons.

Mr. PEELE also briefly responded.

Mr. DUDGEON proposed the sister profession, to which Professor McFADYEAN replied, there being no other medical man present.

Mr. MOORE proposed success to the South Durham and North Yorkshire Veterinary Medical Association, and in doing so said he noticed with satisfaction that the quarterly meetings were well attended, the subjects introduced were good, and the discussions edifying. Such associations fostered brotherly feeling and good fellowship, and extended their knowledge clinically and theoretically.

The HON. SECRETARY briefly replied.

Other toasts followed, and an enjoyable evening was spent.

W. AWDE, *Hon. Sec.*

SCOTTISH METROPOLITAN VETERINARY MEDICAL SOCIETY.

THE summer meeting of the Scottish Metropolitan Veterinary Medical Society was held on August 17th, in the George Hotel, Buchanan Street, Glasgow. Professor W. O. Williams, New Veterinary College, Edinburgh, President, occupied the chair, and there was an attendance of about twenty. The PRESIDENT, in opening the proceedings, said it might seem rather curious for the Eastern Society of Scotland to come to Glasgow, but they had done so with a good will. They had come with the hope not of resuscitating, but of endeavouring to get the Western Society to hold its meetings as it used to do. For the last two years they had not held meetings, and they in the East were beginning to be afraid that the Western Society was dying, if it was not dead. Since calling that meeting they had learned that the Glasgow Society was still alive, and was only, like bears, hibernating, and they hoped that they would come out again and give them good papers. There was in existence not only the Eastern and the Western Society, but there was an endeavour being made at present to make a Northern Society; and it was hoped that all three Societies would join shoulder and shoulder and work together without ill-feeling. It had been suggested that there had been some little ill-feeling between the East and West, and the West were rather inclined to think that they came there to try and rob them of intending members, but they had visited Glasgow for no such purpose. On the contrary, he hoped the East and West would join together and assist the North by giving them a good start in the world. Their Society had been prospering very much indeed of late years. They started as a portion of an old Society; but they had grown stronger and stronger, until now they were the strongest Society in Scotland as regarded numbers. It behoved them all to do their best to keep together, because nowadays, what with Government intervention and the wholesale slaughter of animals, the time would soon come when they would have no animals to treat, or if they had, they would be pet animals. They were slaughtering for glanders, for swine fever, and next they might even slaughter for scab. At this rate they would soon have nothing do. They must, therefore, work together, and endeavour to make their fortunes while they had a chance.

Ventilation and Drainage.

Professor JAMES HUNTER, F.R.C.S.E., Edinburgh, read a paper on "Ventilation and Drainage." What he would attempt in his paper, he said, was to lay down the general principles on which ventilation and drainage had been conducted both in human dwellings and in stables. They lived in a most practical age, and hygiene in all its scientific and practical bearings had come "to stay." With the better appointments on farm dwellings had come the better provision for animals. Dealing with the ventilation of stables, he said that, while roughly speaking a man was given 600 cubic feet of space, a horse was roughly given at between 3,000 and 7,000 cubic feet; but that was possibly too large, and the concensus of opinion seemed to point to something between 1,600 and 1,800 cubic feet, having a floor space of somewhere near 100 square feet, or 2 cubic feet for every pound of animal's weight. Many diseases due to bad ventilation were indicated, and windows, as introducing light, were very essential to health, and also served for ventilating purposes. Single-storied stables, if in an isolated district, were recommended, but in a crowded district perhaps it might be better to have a higher level. As to drainage, he said that matters pertaining to this subject had been much more studied and worked up as regarded appliances than anything connected with ventilation. Drains, it was said, were best avoided, trusting to a well-laid floor with surface ruts to carry away water which ought to be freely used in flushing the stable. If drains were resorted so, they ought, like those in dwelling-houses, to be carefully ventilated. A discussion followed.

Professor SMITH, Principal of the Toronto Veterinary College, who was introduced as the pioneer of veterinary science in Canada, said it afforded him great pleasure to have had the opportunity of being present there that afternoon and meeting with so many members of the profession in this country. He was glad to say on looking round that room that there were four of his old fellow-students present, although a great many years had passed since they occupied the benches in the old college in Clyde Street. He did not, however, come to that meeting with the view of taking any part in the discussion; he came rather with the object of being a patient listener. He was greatly pleased with the paper read by such an eminent authority as Dr. Hunter; and this he could say, that all of them who had had any experience in the treatment of the disease of horses and other domesticated animals had obtained valuable results from ventilation.

Principal M'CALL, Glasgow, said he had listened with the greatest interest to Dr. Hunter's paper, and speaking generally, he agreed with pretty well everything that had been said. If he did appear to disagree with Dr. Hunter on one or two points, he was sure it was owing more to misapprehension of what he said than to any real difference on matters of principle. In the first place, he understood Dr. Hunter to say that he preferred a stable of one storey, because with it it was possible to have ventilation thoroughly carried out. He quite admitted that it may be a more simple thing to ventilate a one-storey stable than one with two or more storeys, but he did not think that, even with a two or three-storey stable, there was any great difficulty in carrying out a thorough system of ventilation. From the experience he had had in the city of Glasgow, he was of opinion that a three-storeyed stable was healthier on the top storey than anywhere else. In fact, in a city such as Glasgow, if he had the power he would object to stables being placed on the ground floor. He would reserve the ground floor for the storage of the vehicles, &c., and put the horses on the higher floors. Horses suffering from chest diseases recovered much more quickly on the top than on the bottom storey. He was particularly pleased with Dr. Hunter's remarks about drainage. He himself, if he were building a stable, would not spend a single shilling on drains on the surface. With proper care and attention there was no difficulty in keeping a stable sweet without them. They were also quite at one in regard to the superficial capacity of the stable. In the case of a single stable, a width of 18 feet was, he thought, all that was required. For a double stable there should be at least 25 feet from wall to wall, and in both cases the trevises should be 9 feet in depth, so as to prevent the horses interfering with each other. The cubic capacity that made one stable healthy might not be sufficient in the case of another; a good deal depended on the attention given to the animals. He would have stables thoroughly cleaned out at least once every day, and if that was done, it stood to reason that they could do with less cubic capacity than in a stable where the droppings, &c., were allowed to collect for a longer period. He could not too severely condemn the practice that obtained in some parts of the country of allowing loose-boxes where young horses were kept to remain uncleaned sometimes for months on end. Hay lofts were often serious obstacles to proper ventilation, and on that account he thought they should never be constructed over stables.

Professor DEWAR, Edinburgh, said he agreed with everything that had been said in regard to the sanitation of stables. Dr. Hunter seemed to depreciate the advantages of ventilation. He himself had always had the greatest faith in ventilation, and that faith was not weakened by the remarks of Professor M'Call. They would all agree with that gentleman when he said that the higher-storey stables were always the healthier, and that in itself was excellent evidence of the value of plenty of fresh air. Dr. Hunter must have made a mistake with his figures in regard to the size of stables. He was

probably about right in placing the width of a single stable at 18 ft., but 25 ft., only 7 it. more, was surely too small for a double stable. Apart from the question of cubic capacity, would not a stable of this width be apt to lead to accidents through the horses stretching back and probably coming into contact with each other? He agreed with everything that had been said about underground drains, being of opinion that they should, as far as possible, be avoided in the case of stables as well as of byres.

Mr. RUTHERFORD, Edinburgh, said the ventilation received from the crevices of the door would, in his opinion, be quite insufficient to maintain a horse in health, unless he were out of doors eighteen out of the twenty-four hours. His experience was that it was of the utmost importance that the foul air generated by the horses, should have rapid and easy means of escape, and in several large stables recently constructed, with which he was connected, they were careful to see that the horses had not only plenty of fresh air at their head, but plenty of light as well. The most perfectly healthy stable he knew of had a window to each stall, in addition to being wide and roomy, and having abundant fresh-air accommodation. He agreed with Professor M'Call that stables for horses should be 9 ft. deep and not less than 6 ft. wide. They might even go the length of 6 ft. 6 in.; but 7 ft. was too much, as at that width the horses might turn round, and accidents occur. He was a thorough believer in the value of thorough ventilation; and in this connection he was bound to say that, in the designing of stables, architects did not know their business. He rarely looked at a new stable with which he did not find fault, and it was generally on the score that it was much too æsthetic and not sufficiently airy. Architects appeared to look far too much to effect, and not enough to the comfort and well-being of the occupants. Only recently plans for a new fifty-horse stable and corresponding warehousing accommodation were submitted, and he at once took exception to them, on the ground that the horses were below and the warehouses above. He advised that the arrangement be exactly reversed, for he was distinctly of Professor M'Call's opinion that, in a crowded situation, the horses ought always to be on the higher storeys. He agreed with Dr. Hunter that there should be no drainage communication with the interior of a stable. Time after time, in some of the newest stables in Edinburgh, small coach stables as well as in large stables, he had had to contend with continual ill-health amongst the horses, and in almost each case it was found that the drains opened into the building. When these were closed up and the drains overhauled, the outbreaks invariably disappeared.

Mr. MITCHELL, Glasgow, said he agreed with all that had been said as to the advantages of ventilation. One thing, however, had been omitted, and that was the dunghill. In Glasgow they generally had the dunghill situated near the stable, and he should like to hear suggestions as to where it should be put down. In the West Indies they got over all difficulties from this source by having the manure dried in the sun every morning.

Mr. ANDERSON, Glasgow, agreed generally with what had been said about the value of ventilation, and the disadvantages of underground drains. He thought there could be little doubt that the healthiest stables in Glasgow were those that were on the higher stories. He always liked plenty of windows in a stable, and the back one should flush with the ceiling, so as to let the foul air escape without coming down.

Principal WILLIAMS said there seemed to be some misconception as to what Dr. Hunter had said in regard to the construction of stables. As he understood him, he did not suggest that stables should be only one storey in height in crowded situations. It was only when they were in exposed situations that the single storey stables might prove the best. He agreed with everything that had been said in regard to the sanitation and ventilating of stables. His

experience could take him back to diseases due to bad drainage and bad ventilation which had now all but ceased to exist. There was periodic ophthalmia, for instance, and glanders was not now nearly so prevalent as it used to be. He had no underground drains at the New College, contenting himself with having the boxes regularly and thoroughly cleaned. His boxes were all open, and the horses under treatment could stand all day long with their heads out. The animals seemed to enjoy it, and they recovered all the sooner for it. There was nothing worse for animals in ill-health than a contaminated atmosphere.

Mr. J. M'LACHLAN YOUNG, Dundee, said the question, "What was contaminated air?" was of considerable importance. Dr. Hunter had stated that men were not only able to live, but to thrive, in sewers. This matter had recently been investigated in Dundee, with the curious result that fewer microbes were found in the atmosphere of sewers than in the ordinary atmosphere above-ground. He did not offer any definite opinion, but it might be that the accumulation of carbonic acid gas which went on in the sewer was fatal to certain germs. When the gas was allowed to escape, as it did through drain openings, it had not the same chance of acting on disease germs.

The CHAIRMAN, in closing the discussion, said he did not, like some speakers, advocate the placing of windows at the head of each stall. Many horses had had their sight spoiled through having a window in front of them. In regard to the plan of having the horses stabled on the top storey of buildings, he would just like to know what insurance company would insure horses housed there as cheaply as they would on the ground floor, and the question of insurance was a matter of considerable importance nowadays to many owners.

Dr. HUNTER, in replying, said he was obliged to Principal Williams for the explanation of his remarks in regard to the construction of stables. What he had said was that, in an open situation, military and other authorities were practically agreed that the single storey stable was the best, but that, when the situation was crowded, it might be necessary to have the horses above the ground floor. It was the same with a stable as with any other building; they had to consider their surroundings. He had intended in his paper, if time had permitted, to have said something on the question of light as an influence of health. There could be no doubt that it was a most important consideration, especially in the case of animals that lived in the open. It was quits a mistake to suppose that he deprecated the value of ventilation. He only gave figures to show what could be done in the way of ventilation, and that in the construction of stables and other buildings it was very frequently overdone. A very common plan in the construction of stables was to have the door about the centre of the rear wall, or immediately behind the horses. A much better plan was to have the door in the gable, but, better still, sacrifice a stall and have the door facing the horses. In this position they were much better able to withstand draughts than they were when the door was behind them. The dunghill should, of course, be as far away as possible from the stable, and they should guard against the heaps getting unduly large, for ir was only when it was built together in big quantities that there was risk from decomposition and other causes.

Mr. H. THOMPSON, Aspatria, next read a paper on

"ANTHRAX."

He said: What is anthrax? According to the numerous writers, anthrax may be said to be a microbic disease of the blood, a disease caused by little solid bodies getting access to the system and destroying the equilibrium between the fluids and solids of the blood. But, seeing that there are so many diseases classed under the head of anthrax, I am rather inclined to think that,

like influenza, it is a very convenient name—in fact, a refuge for the destitute; *i.e.*, when the practitioner is in doubt about his diagnosis, it is handy to assume the disease to be anthrax. May I ask if our expert microscopists are able by microscopic examinations to select the particular spore or rod of bacilli which causes the various different forms of the disease? Or are these, like turnip seeds, only known by their effects or growth?

I am inclined to think that the microscopic examination of the anthrax bacilli is on a par with turnip seeds; in fact, I am afraid we are getting *too* microscopic, too scientific, and—much less practical. Do not let it be understood that I do not value the microscope—quite the contrary; but, with all the excellent work that has been done, do we get any farther advanced in the treatment of these complaints? Certainly the great experts inform us that, by cultivation and inoculation, they have attenuated the virus of many of the different specific diseases, until, by the inoculation of healthy animals with these so-called attenuated preparations, the animals are said to be rendered immune from the disease. But are these preparations such that any ordinary practitioner may use? So far as I can see, great care has to be exercised in their manipulation, and then the immunity may be questioned.

Again, is anthrax—splenic apoplexy—infectious or contagious? I hold that it is neither infectious nor contagious, but very inoculative. Has it ever, I ask, been known in this country to rage as an epidemic endemic? It is very rare that we hear of more than two to eight animals being attacked on a farm, and rarer still to hear of ten or a dozen being affected. Again, has it ever been known to spread from one farm to another? It may be carried in the food or water from one farm to another, but such has not been my experience; and from long observation I say, in the first instance, anthrax is a purely dietetic disease, and can be brought on by the different modes of preparing the food, as the following cases which I have met with will tend to show:—

Case I.—In April 1862, a client of mine put twenty-six fine two-year-old shorthorn heifers into some pasture land that had for years been known as a hot-bed for red-water, which generally attacked the cattle in August and September. The land was undrained and on limestone formation, while the herbage was of a very acid character. The animals had been on the pasture about three weeks, when, on visiting them one morning, the herdsman found one dead; he had seen them the night before, when all appeared to be healthy. Little notice was taken of the first death, but before night another was taken ill, and I was sent for. It died, however, before I reached the place. Next morning two more were found very ill, both dying before my arrival. *Post-mortem* examination was made of these, as well as that which died the previous night. All the spleens were found much enlarged, very friable and easily broken down, one of them measuring 2 feet 6 inches in length, 14 inches in breadth, and 6 inches in thickness. Their contents were of a dark, tarry colour, and consistency. The pleural and abdominal cavities, as well as the bladder and intestinal canal, contained large quantities of dark, chocolate-coloured fluid. Two more of the animals were attacked, and died before anything could be done for them. All six were very sudden in their attack, and died in periods ranging from two to four hours. I pronounced the the disease to be splenic apoplexy, and due to something being wrong with the herbage. I ordered the remaining twenty animals to be removed to the farm buildings, and to have a complete change of food. I then thought, and still think, splenic apoplexy to be somewhat analogous to red-water, but of a more aggravated character. Each of the remaining animals received a dose of medicine composed of sulphate of magnesium and choride of sodium, 2oz. each, with a little ginger, in gruel. During the following week sixteen of the animals were attacked by a slight form of red-water. All recovered under treatment with

sodii hyposulphite, 2 oz. to each animal night and morning. Strange to say, about twelve hours after the first dose of medicine was administered, one was attacked with splenic apoplexy. I was quickly summoned, and found the animal standing in the middle of the farmyard, its nose nearly touching the ground, eyes red, and tears running down its cheeks, breathing hard and catchy, frothing at the mouth, trembling all over with muscular twitchings, standing over at the fetlocks, pulse too frequent to count, and, in fact, showing every appearance of rapid dissolution. I had not had the opportunity of seeing the other cases alive, and this one was like following them in double quick time. Being just green from College, and had there been taught that repeated bleedings tended to increase the fibrinisation of the blood, I decided to try this, therefore, although all the symptoms were dead against such treatment, yet if anything were to be done, it must be done quickly. I took one quart of blood, with great difficulty, and gave her sodii hyposulph., 2 oz. in water. The animal soon showed some signs of improvement, but continued to stand in the yard where I first found her. In two hours' time I took another quart of blood, and repeated the sodii hyposulph. After this the animal gradually improved, and in twelve hours from the time she commenced seemed as well as ever, and next day was all right. These cases occurred about the same time as the outbreak in Somersetshire, on which Professor Simmonds and the late Professors Buckman and Voelcker reported at some length before the Royal Agricultural Society on 9th July, 1862. I look upon the outbreak which came under my notice as being due to the want of saline materials in the blood—more particularly the want of common salt—as shortly afterwards the lands in question were well dressed with 8 cwt. salt to the acre, and since that neither red-water nor splenic apoplexy has been seen on the lands.

Case II. February, 1868.—Splenic apoplexy occurred on a farm where over 100 head of store cattle were tied up, four of the animals dying within twenty-four hours. I had not the chance of seeing any of them alive, two being found dead on entering the byres one morning, and two more the following morning. The animals were very much swollen when found; a bloody frothy mucous coming from nose and mouth; rectum and vagina turned out and discoloured, a bloody fluid oozing from both. *Post mortem* showed the spleens to be extensively enlarged and engorged with a dark, tarry fluid, while the cavities of the chest and abdomen contained quantities of dirty coloured water. The bladder also was full of the same kind of fluid, as were the small intestines. I inquired as to the mode of feeding, and found that large quantities of hay and straw were cut, put in a heap, and well soaked with cold water, and mixed with cut turnips. This was allowed to lie until it heated—or fermented—when each animal received a certain portion along with Indian and locust bean meals, and a little decorticated cotton cake. On going to the mixing-house, I found about a small barrowful of the fermented "chop" in the corner, and small quantities sticking to the unplastered walls, slightly moulded, all of which had a nasty, sour smell. I blamed the fermented chop for causing the death of the animals. The fermentation of the chop had been carried too far—beyond the saccharine stage to that of the acetos—and as in the case of No. 1, I considered that too much food of an acid character had been given to the animals. The fermented "chop" was stopped, long hay and straw were given, with crushed oats, bran, and a little of that grand natural saline commodity—common salt, and few turnips. After this no more deaths occurred.

Case III.—On entering his feeding boxes one morning, a client of mine found three of his best two-year-old heifers lying dead, and other three very ill. I was sent for, but before my arrival these three had also died. *Post mortem* was made, with similar results to I. and II. I made inquiries as to the feeding, when, after careful and full investigation, I came to the con-

clusion that death was caused by the use of mouldy undecorticated cotton cake, which had been recently bought at a cheap rate. The cotton cake was ordered to be withheld; the diet was changed to that ordered in No. 2, and no other cases occurred.

Case IV.—In this case four store animals died very suddenly within a short time of each other. I did not see any of them alive. This outbreak occurred about the same time as Case II., my clients being brothers, though six miles apart, and had adopted the same mode of feeding—viz., fermented "chop" hay, with cotton cake, etc. *Post mortem* revealed similar lesions. In this case, pigs, dogs, cats, and poultry had access to the first carcase. All of these succumbed, while one of the men who had skinned the animal nearly lost his life, he having a wound in his hand, and it took him nearly two years before he recovered. The diet, as in the preceding cases, was changed, when the progress of the malady was arrested.

Case V.—One morning two cows, which had on the previous night seemed all right, were found dead. This happened at a small country cowkeeper's. On opening the animals, enlarged and engorged spleens were found, with all the *post-mortem* appearances of splenic apoplexy. Upon inquiring into the mode of feeding, I was shown three barrels containing malt coombs in different stages of maceration. The malt coombs had been put into the barrels, a quantity of boiling water poured on them, and left exposed to the action of the atmosphere. So long as they remained sweet—*i.e.*, in the sugary fermentative stage—no bad effects followed from feeding; but when a portion, however small, of the coombs and wort were left exposed at the bottom of the barrel, this was changed into the acetous fermentative form, and thus contaminated the whole of the new mixture. On inquiry, I found that the barrels had not been washed out for some time, portions having been left in them. This, I concluded, was the cause of the outbreak. The diet was changed, when no more deaths occurred.

Case VI.—This outbreak occurred in March, 1878, when in the course of three days four cows died. I was wired for to meet and consult with two brother practitioners, to determine the cause of the disease. On arrival I found two more animals ailing, off their food and milk, one being much worse than the other, and showing unmistakable signs of anthrax. *Post-mortem* had been made of the four which had died; two of the carcases lying opened up in the corner of a small field presenting all the appearances of splenic apoplexy. On asking as to the mode of feeding, I found that exactly the same process as described in Case II., was being carried out, viz., hay-chop, meals, turnips, and cake, mixed and fermented. I also found in the mixing-house a quantity of *old* fermented chop in a very sour condition. From my previous experience of this manner of mixing and fermenting foods I was very strongly of the opinion that this was the cause of the disease. The chop was put into the manure heap, and the place was thoroughly cleaned out. The cattle were ordered crushed oats with bran and salt, long hay and oat straw. Blood was taken in small quantities from each of the ailing ones at three different times, and sodii hyposulphis with vegetable tonics was administered, when both recovered and no further deaths ensued.

Case VII.—This case happened in March in the current year on the same farm as No. II. Owing to the scarcity of fodder, chopped hay and straw were once more resorted to, when one animal was found dead on entering the byres one morning, showing all the appearances already described. *Post-mortem* revealed a much enlarged spleen and clay-coloured water in the pleural and abdominal cavities. About a week after this another animal was found ailing, and died before I could see her. *Post-mortem* again showed the disease. The chop was stopped and the cattle were turned out to grass, with the result that the disease disappeared.

On reviewing the foregoing cases, we find that four out of the seven are thought to be due to the fermentation of hay-chop. Now, is it possible that the frequent preparation of the mixture can act as a medium for the cultivation of the bacillus subtillus or hay bacillus, converting it from the harmless form to that of the virulent bacillus anthracis, more particularly if a quantity of the previous fermented mixture be combined with each succeeding preparation, so that, in time, "A liitle leaven leaveneth the whole lump." If, as it is said by Buckner that the harmless hay bacillus *can* be converted by recultivation in various soups to the form of the virulent bacillus, why should the same thing not be accomplished in these "chop" preparations, especially when the mixture is supplemented by a portion of cotton cake rich in nitrogen? On the other hand, may the disease be due to the change in the nature of the food from the alkaline to an acid character? This latter view seems to be supported by the cases occurring on the sour grazing lands, as well as those induced by the brewers' grains fermentation.

I have known and read of several cases said to be due to the use of moulded undecorticated cotton cake. Is it not possible for the mould on the cake to act as a medium for the development of the bacilli, forming as it were an intermediate host for one of the stages in the formation of the virulent bacilli? As a preventive, will not the administration of salt have a tendency to supply the suitable saline material necessary for healthy blood functions, but also, owing to its great germicidal properties, be the means of destroying the infantile disease-producing bodies before they can establish their action? Or may not the action of the salt on the fluid portions of the blood be such as to increase its saline properties and prevent the development of the bacilli, as it is only during the last few hours of life that complete invasion of the blood by these takes place? This latter fact leads me to ask, what, then, is the disease prior to the invasion? I say, a loss of plasticity of the blood, due to the want of the proper saline materials necessary to maintain the balance between the solids and fluids of the blood.

With reference to the disposal of carcases after death, we are informed by Professors Brown and McFadyean, in the *Journal of the Royal Agricultural Society*, that the blood of an animal which has died of anthrax loses its virulence in a comparatively short time; that immediately the animal ceases breathing, the multiplication of the bacilli is arrested, as for spare formation a temperature of 70 degs., as well as a supply of oxygen, is required, while in unopened carcases the bacilli are soon destroyed by the putrefactive bacteria; so that when an animal dies suddenly, and the appearance of the body is such as to indicate a suspicion of anthrax, the sooner the unopened body is put under the ground the better, so that the oxygen of the air is entirely shut out, and the temperature is so reduced that spore formation cannot go on, while the putrefactive bacilli do the rest. If this be so, may I ask how it happens that cases have been attributed to the spores having been brought to the surface, from the buried bodies, by the earth-worms? Are these supposed cases or guess-work? Has it ever been proved as a fact, with direct evidence, that such was really the case? Regarding the spores, it is said that, although the rods are readily destroyed by the want of oxygen and a proper temperature, the spores are hard to kill; they can be dried and yet retain their virulent properties. If this be so, have we any direct record that the spores have ever been carried by the wind from place to place, and induced the disease by inhalation, proving it, in short, to be either infectious or contagious; or has the virulence of the spores only been tested by inoculative experiment?

Referring to the cases I have related, as I have already said, I contend that they were purely dietetic in the first instance, being directly traceable to the food, on which, being changed, the disease occurred no more. I fail to see

why there should be such an outcry about an outbreak of anthrax, or why it should be classed under the Contagious Diseases (Animals) Act. I note in the September number (1893) of Professor McFadyean's journal, a record of the reported outbreak from 1887 to 1892. The average of cases to each outbreak is only 2¼ animals; while on page 255 it is reported that "during the recent summer a very considerable proportion of cases returned as anthrax were not of that nature." If it is so infectious and contagious, why does not the disease spread from one farm to another? Why does it stop so suddenly on the change of diet, or does anthrax of this country differ from that of the continent? As far as the microscopist goes with regard to sporelation, Sims Woodhead says (page 285): "It is a well-known fact that the organism cannot form spores when oxygen is absent, and at any temperature below 12 degs. Cent. (Fahr. 53·6 degs.), and below this the bacilli are incapable of existing for any length of time." Again, the same writer says (page 276): "This spore formation will not take place below 24 to 26 degs. Cent. (75·2 to 78·8 degs. Fahr.)"; while at page 277: "The one physical condition that seems to be fatal, or, at any rate, injurious, to anthrax spores is strong sunlight, which appears to destroy them in whole, or part of their power of fresh development." Klein says (page 154): Spore formation occurs, all things equal, at all temperatures from 18 to 45 degs. Cent. (64·4 to 113 degs. Fahr.); while in the VETERINARY JOURNAL, 1886 (page 330), Fleming on Pasteur's work, says: "At a temperature of 108 to 109 degs. Fahr. no spores were cultivated, and at this temperature cultivation of bacilli devoid of spores was produced, but in a few weeks the crop perished, and on being sown in a medium, produced no result." As already stated, Brown and McFadyean say 70 degs. Cent. for spore formation. Now, when we are told of the varieties of temperature at which spore formation takes place, that the bacilli are only found in the blood a few hours before death, that the spores cannot be formed in the body, and that the putrefactive bacteria destroy the bacilli in twenty-four to thirty hours, according to one party, while another says it takes a week for this to be accomplished, who are we to believe? I am inclined to think that we are getting a little bit like the sheep following the wether or a "will o' the wisp."

The discussion on Mr. Thompson's paper was adjourned until next meeting. On the motion of the Chairman, Professor Smith, Toronto, was elected an honorary member of the Society. The usual votes of thanks were passed to the readers of the papers, and thereafter the proceedings terminated.

Dinner.

The members afterwards dined together—the President again presiding. Dinner over, the President proposed in succession the toasts of "The Queen," "The Prince and Princess of Wales and the other members of the Royal Family," and "The Navy, Army, and Reserve Forces," Dr. James M'Intosh M'Call, as a member of the Yeomanry, replying for the latter.

Dr. HUNTER proposed "The Royal College of Veterinary Surgeons," alluding to the fact that they had present with them on that occasion no fewer than four members of the Council of that august body—Principals Williams and M'Call, Mr. Harry Thompson, Aspatria, and Professor W. O. Williams, Edinburgh, the latter of whom was the youngest gentleman that had ever been elected to that important post, and with his father, Principal Williams, established what he believed was a unique position, so far as the veterinary profession was concerned, viz., the position of father and son occupying a seat on the governing body of the profession at one and the same time. Most of them were aware what the Royal College had done for the veterinary profession. Some members seemed to think that they would get on very well without it; but, however well some members might do, there was a general opinion that in a body so large as the veterinary profession they

required some guidance, and perhaps it was best to have one central college situated in London to look after their interests. At the same time, they were not blind admirers of the Royal College, and could easily see that unless it were properly managed it might not do all the good to the members that it ought and might do.

Principal WILLIAMS, who replied, said he spoke in the presence of a great reformer, Mr. Thompson, but he really thought that of late they had been reforming rather fast. Their desire for fresh legislation had outrun the bounds of reason. He considered it was nothing short of a hardship to prescribe for veterinary students examinations equal to those prescribed for the medical profession. Their students were also to be required to stay four years at college as a minimum. That might be quite right and proper for a medical student; but in the case of a veterinary student, who had not the same prospects of remuneration, three years was a long enough term—at least as a minimum. There was no chance of really undeserving students getting through with this system, as they always had the examinations as a check; but it was decidedly unfair to keep a man four years at college if he could satisfy the examiners at the end of his third year. This was a question which affected members of the profession very deeply, and at meetings of that kind they would do well to take the matter into their serious consideration and bring pressure to bear on the Council. The veterinary profession was yearly becoming more and more a family matter, and under the new arrangements it would be more and more difficult for the sons of practitioners to enter it. There were some men in the profession who seemed anxious to have it converted into a co-operative or protection society, who seemed to think there was only one man in the world, and that was themselves, and only one profession in the world, and that was their own.

Mr. RUTHERFORD, in proposing "Kindred Societies," expressed his regret that they had not had a larger gathering on the occasion of their visit to Glasgow. He missed several gentlemen who had taken a leading part in bringing that meeting about, and he hoped business, and only business, prevented them from being present. For some reason or other, the members of the profession did not support these Society meetings in the way that they ought. He had often wondered whether they would not be better with one large and really good Scottish Society, meeting alternately in the different towns, than with two or three district societies meeting always in the same place, and generally only very moderately attended.

Mr. ANDERSON, secretary to the West of Scotland Society, in reply, said they had only to be secretary of a veterinary society for six months to see the marvellous apathy in regard to the welfare of the profession that existed amongst its members. They would send out probably 200 circulars about a meeting, and they would get back about six replies. They would send out 100 notices requesting payment of subscriptions in arrears, and they would very probably get three replies. In Glasgow they had had great difficulty in keeping the Society going at all, but he was thankful to say it was still alive and financially as sound as ever it was. To show the difficulties they had to contend with, he had only to mention that not very long ago one member left them on the ground that his speeches were not reported at long enough length in the papers. Yet it was a fact that that same member took twenty minutes to say what any ordinary man would say in less than five.

Mr. M'LACHLAN YOUNG proposed the "Teaching Schools," and in reference to the remarks of Principal Williams on the extended course, said he had no doubt that the various colleges would do their best to face the new burdens that had been forced upon them, and that, in any event, the interests of the students would not be allowed to suffer.

Principal M'CALL, who replied, said he had special pleasure in replying to this toast in the presence of his old friend Professor Smith, of Toronto. It was a curious coincidence between them that he himself had orginally been appointed to the post which Professor Smith now occupied with so much distinction to himself and advantage to the people of Canada. In regard to Mr. Young's remarks on the Home Colleges, he, with him, was sure, that these colleges would do their best to see that the poor students did not suffer through the changed condition of things. He quite agreed with Professor Williams that the Council, by its action, had thrown a new and, in his opinion, unnecessary burden on the shoulders of parent and others who wished to educate their charges for the veterinary profession. He had made an estimate, and he found that under the new regulations it would cost parents not less than £500 to place their sons in the profession.

Mr. H. THOMPSON.—More.

Professor M'CALL said he knew he was rather under than over the mark. Four years was the minimum, but in the case of many students it would take six, and the average could not be put under five. The new law had been passed but fortunately it was not unalterable. He had been a teacher for thirty-seven years, and personally, he was of opinion, that in the present state of matters the three years' limit was quite sufficient. The past season was the only one in his experience in which it was a case of spinning out lectures, talking against time as it were. That, he need hardly tell them, was not a very satisfactory state of affairs. The Dick College in Edinburgh had always hitherto done well by the students, but he could not refrain from telling them there that but for the tactics pursued by the Principal of that College they would not have been discussing a four years' limit as a practical reality on that occasion. He had no doubt the thing was done for the best; he hoped it would lead to good in the end; but in the meantime it imposed an additional burden on the students, which very many of them would find very difficult to bear.

Professor WILLIAMS proposed the health of Professor Smith, alluding to him eminence as a veterinarian and the universal esteem in which he was held by the profession at large.

Professor SMITH thanked them all for the more than cordial reception they had given him, He had had very great pleasure indeed at being present at that day's meeting, listening to the highly interesting remarks that had been made, and also in meeting so many friends of bygone days. He had gone to Canada with a good deal of trepidation, but by hard work and an honest endeavour to inculcate those principles which had been infused into his mind by the late Professor Dick, whose name he still revered, he was thankful to say he had been so far successful, and had raised up an institution which was held in the very highest repute, not only in Canada, but in the United States as well. During the last few years especially they had had very large attendances. Turning to general veterinary topics, Professor Smith said they had lately heard a good deal about the embargo that had been placed on Canadian cattle. Speaking as an inspector of Ontario, he could say that pleuro-pneumonia in cattle was quite unknown in that province, and they in Canada felt strongly that a mistake had been made somewhere.

A number of other toasts were duly proposed and responded to, and with songs and recitations a very pleasant evening was spent.

P. MOIR, *Hon. Sec.*

Correspondence.

THE ARMY ANNUAL VETERINARY REPORT.

SIR,—Will you kindly allow me, through the medium of your journal, to correct an error which appeared in the Army Veterinary Report for 1893, as reported by the *Overland Mail* of September 7th, 1894.

In referring to glanders and farcy, the report stated that "the Imperial army in Egypt is free, although glanders and farcy are prevalent amongst horses of the Egyptian army and police." As regards the Egyptian army, I will leave to Veterinary-Captain Griffith, their P.V.O., the trouble of correcting the error; but for the police I am in a position to state that *no cases of glanders or farcy existed amongst their horses* in 1893.

The following cases of glanders and farcy were detected in Egypt during year 1893:—

Jan.	5th—1 horse was destroyed in Alexandria.	
Feb.	7th—1 „ „	„
„	7th—1 mule „	„
March	4th—1 horse „	„
„	9th—2 „ „	„
„	13th—1 mule „	„
April	4th—1 horse „	„
May	31st—1 „ „	Cairo.
July	24th—1 mule „	Alexandria, the property of the municipality.
Oct.	2nd—2 horses were destroyed in Alexandria.	
„	30th—1 mule, of the Public Works Department in Cairo, was destroyed.	
Dec.	3rd—1 horse was destroyed in Cairo.	
„	4th—1 „ „	„
„	9th—1 „ „	„
„	6th—1 mule, the property of the Alexandrian municipality, was destroyed.	

From the above list it will be seen that only one case occurred amongst animals belonging to the Egyptian Government, viz., of Public Works Department; two amongst animals of the Alexandrian municipality; the remaining fourteen occurred in private stables, and *none* amongst horses of the Egyptian police.

W. LITTLEWOOD, M.R.C.V.S.,
Sanitary Department, Egypt.

CAIRO, *September 22nd.*

Notes and News.

POISONING OF COWS BY ALCOHOL.—We learn, that at Reefton, New Zealand, three cows died through drinking from a creek into which six-hundred gallons of illicit spirits were spilt.

PHENOMENAL PRECOCITY.—The *North British Agriculturist* says that a quey, two years old, belonging to Mr. John Smith, Butler's Croft, Dyce, has given birth to three calves, two males and a female.

SLAUGHTER OF HORSES IN THE FRENCH ARMY.—The French Minister for War has authorised all mounted corps, remount establishments, and the military schools, to procure, and add to their list of equipment, an apparatus arranged on the principle of Bruneau's mask for the slaughter of horses.

VETERINARY MEDICINE IN EGYPT.—We learn that M. Piot, Veterinary-Surgeon-in-Chief to the Egyptian State Domains and General Secretary to

the Egyptian Institute, has had the honourable title and rank of Bey conferred on him by a decree of the Khedive. M. Piot is a graduate of the Alfort Veterinary School.

TUBERCULOSIS IN CANADA.—Last August, twenty-two head of high-bred cattle affected with tuberculosis, were slaughtered at the Canadian experimental farm at Brandon. Among the herd were some of the best specimens of Galloways, Ayrshires, Shorthorns, Holsteins, and Herefords in the Dominion, and the authorities are commended for their prompt action in destroying those diseased animals.

ANIMAL CONTAGIOUS DISEASES IN BURMA.—We learn from Rangoon, that a Bill has been introduced into the Legislative Council which imposes on village headmen in Burma, the duty of taking such measures to prevent the spread of cattle disease as the local Government may prescribe. This amendment of the Village Act is considered the best means of giving effect to the prevailing desire for some check to the heavy losses from disease every year.

INOCULATION OF HORSES AGAINST ANTHRAX.—Pasteur's method of prophylactic inoculation against anthrax has recently been practised on a considerable scale in Russia. It has now been decided to open a laboratory in St. Petersburg for the preparation of the protective material. The French Société de Vaccine Charbonneux de Pasteur is also constructing one in Nijni Novgorod, and proposes later to build similar laboratories in the Caucasus and in Southern Russia.

A RABID CAT.—On October 13th, while a boy, sixteen years old, was walking at Clonlyon, King's County, Ireland, a cat sprang upon him and bit him severely in the thigh and the little finger of the left hand. The animal was thrown to the ground, but it again attacked the boy and wounded and clung to the left hand until it was choked off. A veterinary surgeon who examined the carcase pronounced the cat to have been suffering from rabies. The boy was to be sent to the Pasteur Institute, Paris, for treatment.

MEAT PRESERVATION.—Professor Nocard, of the Alfort Veterinary School, in accordance with the request of the Police Prefect, has sent in to the Seine Health Council a report on the process of preserving meat and fish with borax, boric acid, and sodium bisulphite. The report states that the use of the above substances is deleterious in two ways—they permit unsound articles to be preserved, and their direct action may deprive food thus preserved of some of its nutritive properties by facilitating the formation of organic elements absent in fresh meat. It is likewise probable that sulphuric acid, which is manufactured arsenical pyrites, and the sulphur compounds obtained by its aid, may contain traces of arsenic. M. Nocard condemns the use of borax, boric acid, and the bisulphites of sodium and potassium.

CATTLE TICKS IN QUEENSLAND.—The *Brisbane Courier* has the following note on the damage caused by cattle ticks in Queensland:—A mob of store cattle, travelling from Westmoreland station bound for Townsville, were observed to be infected with ticks, and a considerable number of deaths occurred in the mob from that cause. A constable then in the district sent a number of specimens of the ticks to the chief inspector, who submitted them to Mr. Tryon, but they were not in a condition for Mr. Tryon to recognise to what order they belonged. Since the passage of these cattle, ticks of the same description have attacked the cattle on several runs along the line of route of the infested cattle, and a considerable mortality has been the result. On one or two of the stations the death rate from that cause has been heavy. On one station it is reported that while the stockmen were branding the calves they picked off the ticks in handfuls, and the ticks had to be actually burnt through before the branding iron reached the skin. The chief inspector has instructed the district inspector to visit the district and

report fully on the matter, and to send to Brisbane, in a state of good preservation, specimens of the tick.

THE PUBLIC SLAUGHTER OF INJURED HORSES.—A short Act of Parliament passed recently, and which will probably apply to towns more than to rural districts, but which, nevertheless, does extend all over the country, bears the title of the Injured Animals Act. It sometimes happens that a horse receives a serious accident on the road, and that, being impossible to remove it, the only course is to kill it. The police generally do what they can in such cases for the purpose of preventing any undue obstruction to the traffic, but as they have not had any power to cause the animal to be destroyed without the consent of the owner, and as the owner is often not available at the moment, much inconvenience has resulted to the public, and much suffering to animals which ought to have been killed as soon as possible. This Act has been passed for the purpose of getting out of this difficulty. Its first section gives it the name. The second section declares that if a police constable finds any horse, mule, or ass so severely injured that it cannot without difficulty be led away, he shall, if the owner is absent or refuses to consent to the destruction of the animal, at once summon a duly registered veterinary surgeon, if any surgeon resides within a reasonable distance, and if it appears by the certificate of such veterinary surgeon that the animal is mortally injured or so severely that it is cruel to keep it alive, it shall be lawful for the police constable, without the consent of the owner, to slaughter the animal or cause it to be slaughtered with such instruments or appliances, and with such precautions and in such manner, as to inflict as little pain and suffering as practicable. The third section deals with expenses incurred in enforcing the Act, and says that they may be recovered from the owner as a civil debt put before the magistrates. These expenses are to include the cost of slaughtering the animal and removing the carcase from any public street or place. Any other expenses are to be paid out of the police fund.

Communications, Books, Journals, etc., Received.

COMMUNICATIONS have been received from W. Littlewood, Cairo; Mr. Desmond, Warrnambool, Australia; Dr. Armand Ruffer, London; P. Moir, Edinburgh; W. Awde, Stockton-on-Tees; A. W. Hill, London; W. R. Carr, Kirkton, Canada; J. J. Walker, Londesboro, Canada; F. C. Mahon, London.

BOOKS AND PAMPHLETS: *Remy Saint-Loup*, Les Oiseaux de Basse-Cour; *H. Boucher*, Hygiene des Animaux Domestiques; *Nowroji Dorabji Dhakmarvala*; Demonstrations in the Modes of Handling and Examining the Horse; The Johns Hopkins Hospital Reports, Vol. IV., Nos. 4-5; Procés-Verbal de l'Académie Royale de Médecine de Belgique; Bulletin des Séances de la Société Nationale d'Agriculture de France; *W. B. Walters, C.B.*, Saddlery, and the Causes, Prevention, and Treatment of Sore Backs; *M. Sussdorf*, Lehrbuch der Vergleichenden Anatomie der Hausthiere.

JOURNALS, ETC.: *Medical Press and Circular*; *Cape Colony Agricultural Journal*; *Thierarzt*; *Live Stock Journal*; *Annales de Médecine Vétérinaire*; *Clinica Veterinaria*; *British Medical Journal*; *Recueil de Médecine Vétérinaire*; *Echo Vétérinaire*; *Baily's Magazine*; *Veterinarian*; *Journal de Médecine Vétérinaire et de Zootechnie*; *Presse Vétérinaire*; *Revue Vétérinaire*; *Journal of the Royal United Service Institute*; *Journal of the Royal Agricultural Society of England*; *Scottish Farmer*; *Œsterreichische Zeitschrift für Wissenschaftliche Veterinärkunde*; *Journal of Comparative Medicine and Veterinary Archives*; *Mark Lane Express*; *Lancet*; *Live Stock Journal*; *Edinburgh Medical Journal*.

NEWSPAPERS: *Devon and Exeter Daily Gazette*; *Western Morning News*; *Edinburgh Evening Dispatch*.